University of London

AN EMPIRICAL INVESTIGATION OF ASIA-PACIFIC STOCK MARKETS

By

Su-Chin Yang

A Thesis Submitted to the School of Oriental and African Studies for the Degree of Doctor of Philosophy

Department of Economics
SOAS

1999

To my mother and father

Abstract

The purpose of this study is to investigate the effects of a decade of financial deregulation on stock markets in term of market integration within Asia-Pacific countries. It investigates the existence of inter-relationships between five emerging and two developed stock markets in the region. Then, it examines the 'causal' relationships between each market and its country's economic fundamentals.

The study is comprised of three major sections of empirical analysis: In the first section, three tests, **correlation coefficients**, **unit root tests**, and **cointegration tests**, are used to examine the short-term as well as long-term changes in the co-movement patterns of Asia-Pacific stock markets before and after financial deregulation. The second section employs **VAR model** to estimate and analyze the dynamic interdependencies among Asia-Pacific stock markets and trace out the effects of shocks to those markets. It also examines whether there is one or more dominant or particularly influential market within the region. Finally, the third section investigates the existence of interactions between stock returns and domestic economic fundamentals by applying **causality tests**. It focuses on the predictive content of historical information of stock returns in explaining economic variables, and hence, it tests whether the economic variables do or do not Granger-cause stock returns, and vice versa.

The study provides a number of interesting and important results which can help us to understand the nature of stock market integration as well as evolution of financial integration in this increasingly important region. The study suggests that financial liberalization has enhanced the inter-relationships among Asia-Pacific stock markets, and that therefore high capital controls account for instances of low interactions. The study shows that the effects of a shock to stock markets are completed within two days, indicating that stock markets adjust quickly, but not instantaneously, to all relevant information in the region. The study also finds that Japan and Hong Kong are the most influential markets in terms of their effects on other markets in the region. Moreover, the result of the absence of cointegration may simply rule out the existence of a long-run equilibrium tending relationship, but does not invalidate any short-run relationships which may arise due to profit-seeking opportunities in transactions.

Furthermore, examining the 'causal' relationships between a stock market and economic fundamentals shows that the exchange rate and the corporate bond rate are the only two out of several factors tested that are 'causal' of stock returns in many markets in the Asia-Pacific region. In short, the results are consistent with the view that stock returns only respond to monetary variables. Hence, one possible implication is that most of the indicators of macroeconomic fundamentals in the Asia-Pacific region are not the predictors of stock returns and that information captured in a stock market does not reflect changes in its country's macroeconomic fundamentals.

Acknowledgements

I would like to acknowledge with gratitude to my supervisor - Professor Laurence Harris - for his constant guidance and supervision.

I wish to thank the many people who have assisted me during the collection of materials and research for this thesis.

Special thanks also go to my former colleagues at Chung-Hua Institution for Economic Research.

Finally, it is to my parents that I owe my greatest and sincerest thanks.

Table of Contents

Page

Page

Page

List of Tables

Page

List of Figures

Page

Page

Page

Chapter 1 Introduction

1.1 Objectives of the Study

There has been an increasing interest in the nature of relationships among Asia-Pacific capital markets in the last decades. This interest has been aroused mainly because of the increase in the flow of capital across countries which, in turn, is mainly due to market deregulation measures, technological developments in communications and trading systems and the emergence of innovative financial products. As Asia-Pacific stock markets function in different cultural, institutional and regulatory circumstances from those in developed markets, a substantial amount of research is still required to provide a better understanding of many relevant issues. Hence, the overall objective of this study is to investigate the behavior of stock markets within the Asia-Pacific region by applying statistical and econometric techniques.

Given the recent difficulties of Asia-Pacific stock markets, the importance of this study is clear. By investigating the degree of integration between stock markets and examining the possible sources of contagion, this study provides valuable insights into the behaviour of the region's financial markets. Specifically, this study addresses the following questions:

(1) How are Asia-Pacific stock markets related to each other?

(2) How much of the price movements in one stock market can be explained by

changes in other markets?

(3) How rapidly are the price movements in one market transmitted to other markets within the region?

(4) Has the removal of capital controls increased market interactions?

(5) What is the relation between stock market development and domestic economic performance?

(6) What benefits do Asia-Pacific stock markets provide to the domestic economy and to international investors?

In attempting to answer the above questions, one approach is to investigate the existence of inter-relationships among Asia-Pacific stock markets, including the five emerging markets and two developed markets in the region. Another approach is to examine the 'causal' relationships between each individual stock market and its country's macroeconomic fundamentals.

Concerning the first approach, the study examines the correlation coefficients between daily returns on these markets. The higher the correlations, the lower are the benefits of international diversification within the region and also, in the short term, the greater is the inter-relationship between stock markets. Also, this study looks at long-term inter-relationships by carrying out unit root and cointegration tests. The time series data used for the correlation and cointegration estimates are divided into sub-periods, reflecting pre-liberalization and post-liberalization regimes. A

comparison of results for sub-periods enables one to consider the impact of liberalization on the regional integration of stock markets. Then, in order to examine the degree to which a shock, in the form of a change in one stock market's prices, is followed by a change in other stock markets' prices, this study estimates a vector autoregressive (VAR) model.

Concerning the second approach, this study investigates the existence of interactions between stock returns and macroeconomic fundamentals by applying Granger Causality tests. It focuses on the predictive content of historical information of stock returns in explaining macroeconomic variables, and hence, it tests the hypothesis of whether macroeconomic variables do or do not Granger-cause stock returns and vice versa.

This study is an extension of previous research in a number of ways. First, this study concentrates only on Asia-Pacific stock markets and therefore takes an Asia-Pacific regional, rather than a global perspective.

Second, the data used in the this study consists of time series of daily stock market indices, in terms of local currency units, of the eight Asia-Pacific stock markets. The data set has been chosen for several reasons. First, since a month or even a week may be long enough to conceal interactions that may last only for a few days, it is more appropriate to use daily data than monthly or weekly data in order to capture the potential interactions. Second, to examine the diversification of local stock market risk

rather than currency risk, the indices in these markets are in local currencies.

Third, to investigate the effects of financial liberalization on regional stock markets, the data set is divided into two sub-periods. The study identifies the first sub-period as a period during which most Asia-Pacific stock markets were less accessible to foreign investors and the second sub-period as a period involving a higher level of financial liberalization.[1] The two sub-periods also correspond to the pre-and post-financial crash of October 1987.

Fourth, this study identifies the possible causal relationships (in the Granger sense) between each stock market and its macroeconomic fundamentals. Accordingly, the Granger Causality test is related to the idea of the impact of historical information of one variable on another variable. It allows one to examine the role that stock markets have played in changes in the macroeconomic fundamentals but also investigates the historical feedback effect of these macroeconomic variables on the stock markets in Asia-Pacific countries.

The main results from this study can be summarized as follows. The study suggests that financial liberalization has enhanced the inter-relationships among Asia-Pacific stock markets, and that therefore high capital controls account for instances of low interactions. This study shows that the effects of a shock to stock markets are

1 Note that financial liberalization and the inflows of investment in most of the Asia-Pacific countries have become most significant after 1987. For further detail, see the section in this study on the discussion of inflows in the Asia-Pacific region. Also, see *World Financial Markets* by JP Morgan and *World Economic Outlook* database by International Monetary Fund.

completed within two days, indicating that stock markets adjust quickly, but not instantaneously, to all relevant information in the Asia-Pacific region. The study also finds that Japan and Hong Kong are the most influential markets in terms of their effects on other markets within the region. Moreover, the result of the absence of cointegration may simply rule out the existence of a long-run equilibrium tending relationship, but does not invalidate any short-run relationships which may arise due to profit-seeking opportunities in transactions.

Furthermore, when examining the 'causal' relationships between a stock market and its country's economic fundamentals, the result shows that the exchange rate and the corporate bond rate are the few factors that are 'causal' to stock returns in many markets in the Asia-Pacific region. In short, the results are consistent with the view that stock returns only respond to monetary variables. Hence, one possible implication is that most of the macroeconomic fundamentals in the Asia-Pacific region are not the predictors of stock returns and that information captured in a stock market does not reflect changes in macroeconomic fundamentals.

However, caution must be exercised in interpreting the results. First, the notion that cointegration has implications for financial market efficiency has been challenged in recent years (Dywer and Wallace, 1992). Since this proposition hinges critically upon the definition of market efficiency, this study only considers the term 'market efficiency' in terms of Granger's traditional definition. Indeed, the absence of

cointegration should simply mean that it rules out the existence of a long-run equilibrium tending relationship. Second, it is important to note that the test for Granger-causality is more a temporal ordering with predictive ability rather than 'causality' as that word is commonly understood. Hence, the meaning of 'causal' in this study should be seen and understood as 'preceding'. Finally, although the stock markets within the Asia-Pacific region operate in different time zones, there is only a small gap between them. Yet, the implications of using this overlapping data should be considered when interpreting the empirical results.

1.2 Organization of the study

Following the Introduction (Chapter 1) and literature review (Chapter 2), this study is made up of three major chapters of empirical analysis. Chapters 3 and 4 test for inter-relationships among Asia-Pacific stock markets. Chapter 5 then investigates the impact of domestic macroeconomic variables. This section provides a brief description of each chapter.

Chapter 1 briefly reviews the two major recent trends of market integration and emerging stock markets. Then, it considers the major development of financial liberalization and the current status of stock market internationalization among Asia-Pacific countries during the 1980s and1990s. This chapter also provides the research questions, as well as the objectives and importance of the study.

Chapter 2 provides a review of the literature on both issues of market integration and the impact of domestic fundamentals on domestic stock markets. First, as far as the review on market integration is concerned, the chapter starts with a review of short-term correlation tests, and long-term unit root and cointegration tests. Next, it reviews ARIMA and VAR modeling for the issues of inter-relationships between the world's stock markets. Several multi-factor models, especially the APT model, and some studies which use the Granger test, are then also reviewed to investigate the impact of domestic fundamentals on domestic stock markets. Finally, the chapter reviews the literature relating to the emergence of Asia-Pacific stock markets.

Chapter 3 presents the empirical results from correlation, unit root and cointegration tests examining Asia-Pacific stock markets. The chapter addresses the issue of stock market co-movement in both a short-term and a long-term framework and tests for it within not only a bivariate but also a multivariate setting. The Johansen method of cointegration test that allows for the simultaneous determination of several stock market indices which may arise due to such phenomena as capital mobility and international arbitrage is applied. In addition, the relationship between the eight Asia-Pacific stock market indices are checked during two different time periods in this chapter. They correspond to pre- and post- financial liberalization and major international events, such as the October 1987 crash. A description of the data set and the methodology employed are also included in this chapter.

Chapter 4 discusses the methodology, including the Impulse Response Functions (IRFs) and Variance Decompositions (VDCs) of the VAR model. This chapter investigates which stock market led or was more exogenous to the system by constructing an eight-dimensional VAR model. This chapter also decomposes the total forecast error variance (or shock) of each market in terms of the proportions attributable to innovations (or shocks) in each variable in the system including its own. Hence, implications for the patterns of the interdependency are addressed and implications are discussed which affect how this formulation may be used to understand the dynamics behind speculative Asia-Pacific stock markets. Different

time periods are also tested in this chapter, corresponding to pre- and post- financial liberalization periods and major international events, such as the 1987 crash. Finally, the empirical results and their implication are discussed.

Chapter 5 investigates the existence of interactions between stock returns and macroeconomic fundamentals by applying Granger Causality tests. The following variables are used in this chapter: money supply, inflation, exchange rate, treasury bill rate, yield on government bonds, corporate bond rate, term structure, default risk premium, industrial production, trade balance, gross national product, and private consumption. This chapter focuses on the predictive content of historical information of stock returns in explaining macroeconomic variables and examines the historical feedback effect of these macroeconomic variables on the stock markets. Consequently, this chapter first looks at the methodology of the Granger Causality test. Then, it investigates the direction of causality between national stock markets and domestic fundamentals. Details of the data and the results are also included.

The final chapter, Chapter 6, contains a summary and the conclusions of this study. Several issues are suggested for future research.

1.3 Prior Research: Issues and Background

As a preliminary to the main study, this section discusses the issues regarding market integration and emerging stock markets. It also reviews both the main liberalization measures undertaken by countries in the Asia-Pacific region during the 1980s and 1990s and the main characteristics of regional stock market flows, transactions, and capitalization. The review provides the evidence necessary to define 1987 as a critical dividing point between pre- and post-liberalization periods in the Asia-Pacific region. Thus in subsequent chapters, the time series data are divided into sub-samples such that the post-1987 data may be identified as representing a more liberalized phase than the pre-1987 data.

1.3.1 Issues

The last two decades have seen two important trends in the world's stock markets. The first trend is the increasing interaction among different national stock markets and, apparently, greater integration. The second trend is the rise of the so-called 'emerging stock markets'. Hence, for the purpose of better understanding the setting for this study, it is important to define and to discuss these two trends.

(I) Market Integration

"Market integration" can be defined as a state in which identical assets in different stock markets provide the same risk-adjusted expected returns.[2] Theoretically, integration between national markets directly relates to the notions of co-movement and interaction between them. That is, in an integrated stock market, the prices of all stocks should fully reflect their relative investment values. Hence, new information is directly transmitted between national stock markets and we should observe that national stock markets' returns are closely correlated with each other. In such circumstances, the opportunities for investors to improve the risk-return characteristics of their portfolios through international diversification would be low (or nil in the extreme case).

In fact, during the 1980s and 1990s national stock markets became subject to greater international influence. One major impetus came from the removal of controls on capital movements; another came from major institutional developments, some in response to deregulation, others reflecting advances in technology. Stock markets are believed to have become more closely and deeply interconnected as a result. However, apart from a few uncomplicated situations, the question of how fully national stock markets are integrated with each other is difficult to answer precisely. The conditions

[2] In contrast, "market segmentation" suggests that the risk-return relationship in each country's stock market is determined by domestic factors.

for perfect integration may be incomplete in part because of the barriers to capital flows, and partly because the assumptions of the efficient markets hypothesis cannot be met. In other words, integration may still be far from complete due to remaining taxes, regulations and legal differences partly isolating some stock markets from the world market. Thus, a perfectly integrated efficient market is one in which, conditional upon the information set, rationally expected returns correctly price risk and investors are able to fully optimize. However, actual pricing may diverge from that modeled by the full efficient markets hypothesis due to imperfect information or 'noise-traders' who make bad use of the available information.

(II) Emerging Stock Markets

In the 1990s the fastest rising stock markets in the world were those in developing countries, especially those in the Asia-Pacific region. Emerging stock markets can be defined as stock markets growing in size and sophistication, with the implication that all have the potential for further development.[3]

Between 1990 and 1997 emerging stock markets have risen rapidly both in value and in terms of financial flows, but they remain different in many ways from

[3] According to the IFC's definition a stock market is said to be "emerging" if it meets at least one of two general criteria: (i) an Emerging Economy Criterion, and (ii) a Developing Stock Market criterion. See International Finance Corporation, *Emerging Stock Markets Factbook*,. various issues.

developed stock markets.[4] For example:

- price and return patterns: emerging stock markets generally offer higher rates of return than developed markets.

- volatility: high price volatility[5] in emerging markets indicates the existence of speculative inefficiency.

- financial deregulation: in the 1980s many emerging stock markets had strict capital controls that insulated the local stock exchange from global markets, these markets have progressively moved toward a more liberalized regime for foreign investment.

Overall, the combination of increasing market integration among the world's stock markets and the development of emerging stock markets has stimulated the research objectives detailed in section 1.1. To a large extent they revolve around one central issue, the extent of links, co-movement or interaction between stock markets in different countries. It is widely believed that interaction increases as a result of financial liberalization, particularly the reduction or abolition of capital controls. Therefore, the next sub-section reviews the extent of financial liberalization and stock market internationalization undertaken by the Asia-Pacific region.

---

[4] For discussion regarding emerging stock markets, see Howell (1994).

[5] It is believed that high stock price volatility in emerging stock markets may be caused by small market effects and information imperfections.

1.3.2 An Overview of Liberalization and Internationalization of Asia-Pacific Stock Markets during 1980s - 1990s

Asia-Pacific stock markets, prior to the 1980s, were generally underdeveloped and played a less important role in intermediating resources. Alongside the underdeveloped stock markets, capital controls in this region were generally imposed to support exchange rate arrangements, as well as to insulate domestic interest rates from foreign influences. This combination discouraged competition in the financial system, and hence, limited improvements in financial intermediation.

However, during the 1980s, changes in the external environment, such as rising international interest rates and the slowing of market growth in developed countries, stimulated most of the Asia-Pacific countries to liberalize their financial systems. The resulting changes in the financial structures encouraged foreign direct investment and the promotion of the international movement of capital more generally.

To provide the background for this research, this section first reviews the financial reforms of Asia-Pacific countries with an emphasis on: the liberalization of interest rates; the relaxation of capital and exchange controls; and the shift toward more flexible exchange rate arrangements. Second, to enhance the understanding of Asia-Pacific stock markets, the section also provides an overview of the current status of stock market internationalization.

1.3.2.1 Financial Liberalization

Until at least the late 1970s, most Asia-Pacific countries maintained tight control over their financial markets, interest rates, and credit allocation. Thus, over time, these highly controlled financial systems created distortions in investment decisions and generally failed to intermediate funds efficiently. Those tight controls over the financial systems in the Asia-Pacific region were increasingly viewed as inappropriate to meet the needs of increasingly complex and sophisticated economies and, during the 1980s, many countries in the region liberalized their financial systems. The degree to which financial liberalization has taken place varies by nation, as well as with respect to its speed once the process was under way. Nevertheless, financial liberalization in Asia-Pacific countries has been a gradual and continuing process.

In general, the financial liberalization undertaken by these countries involved liberalizing interest rates, reducing controls on credit, enhancing competition and efficiency in the financial system, strengthening the supervisory framework, and promoting the growth and deepening of financial markets.[6]

In this research, as far as the Asia-Pacific stock markets are concerned, the financial liberalization programs treated as key are:

- Relaxation of capital and exchange controls: capital and exchange controls are the first one among other selected reform programs under review since they are

[6] See Cheng (1986).

potentially a major barrier to equity portfolio flows.

- Exchange rate arrangements: capital flows between different stock exchanges involve foreign exchange transactions, therefore, the Shift in exchange rate arrangements are discussed below.

- Liberalization of interest rates: theoretically, interest rate liberalization promotes efficient investment and it has also been argued that capital controls are redundant in the face of flexible interest rates,[7] [8] [9] this section also reviews the liberalization of interest rates.

(I) Relaxation of Capital and Exchange Controls

The last two decades have seen successive relaxation of international capital controls in the Asia-Pacific region. With greater capital mobility, the level of investment a country can undertake need not be constrained by the level of domestic saving. Financial investment flows enable each country's portfolios of wealth to be invested in stock markets across the world; thus higher capital mobility should lead to greater market integration.

Asia-Pacific countries differ considerably as to when liberalization of capital

---

[7] See McKinnon (1991) for details of "sequencing theory."

[8] Singapore, Korea, and Taiwan have adapted to this process by liberalizing the domestic financial sector while maintaining a considerable degree of capital control.

[9] Cargill, Cheng, and Hutchison (1986) suggest that capital controls are redundant in the face of flexible interest and flexible exchange rates.

controls was initiated, as well as with respect to their degree of capital mobility. For example, a number of countries chose to deregulate capital controls while initiating reforms designed to strengthen the domestic financial system and to integrate it more closely with international markets. In some cases, however, capital controls were removed almost completely at the very beginning of their reform programs.[10]

Table 1.3.2.1-1 Summary of the Relaxation of Capital Controls

	1972	1973	1974	1975 - 1977	1978	1979	1980 - 1982	1983	1984 - 1988	1989	1990	1991 - 1997
Australia	*	*	*	*	*	x	^	o	o	o	o	o
Hong Kong	o	o	o	o	o	o	o	o	o	o	o	o
Japan	*	*	*	x	x	x	^	^	^/o	^/o	^/o	^/o
Korea	*	*	*	*	*	*	*/x	*/x	*/x	x	x	x
Malaysia	x	^	^	o	o	o	o	o	o	o	o	o
Singapore	x	x/^	x/^	^/o	o	o	o	o	o	o	o	o
Taiwan	*	*	*	*	*	*	*/x	*/x	x	x/^	x/^	x/^
Thailand	x	x	x	x/^	x/^	x/^	x/^	x/^	x/^	x/^	^	^/o

Key:

- * Heavy Restrictions
- x Moderate Restrictions
- ^ Mild Restrictions
- o No Restrictions

As shown in Table 1.3.2.1-1, Hong Kong and Malaysia have been free from capital controls since the mid-1970s or earlier, and Singapore eliminated restrictions on capital flows in the mid-1970s. More cautious moves toward capital mobility have taken place in Australia and Japan. Partially free capital movements have existed in Thailand. Controls on capital flows have remained in Korea and Taiwan. A summary

[10] For details of the difference in the sequencing of deregulation of capital controls, see McKinnon (1991) and Santiprabhob (1992).

of each individual country is as follows:

Hong Kong liberalized its capital controls in December 1972, hence, this makes Hong Kong's capital market one of the least restricted in the region.[11] In Malaysia, since 1975 there have been essentially no limitation on capital inflows, nor on capital outflows as long as they are not financed by local borrowing in Malaysia.[12] In Singapore, capital controls were progressively liberalized through the 1970s and were abolished in 1978.[13]

Australia and Japan have both adhered to cautious and measured pace of financial liberalization. It was not until January 1979 when the Campbell Committee, a Committee of Inquiry into the Australian financial system, was announced that Australia started to deregulate its capital controls. In October 1983, virtually all the controls on international transactions were lifted.[14]

The process of capital market liberalization in Japan was set in motion by the mid-1970s. Then, Japan amended its Foreign Exchange and Foreign Trade Law in December 1980 which liberalized most capital controls. The 1984 Yen/Dollar Agreement provided further impetus to remove barriers to international capital

---

[11] See EIU's *Financing Operations in Hong Kong*, various issues. Also see Freris (1991) and Ho, Scott, and Wong (1991).

[12] See EIU's "Financing Operations in Malaysia," 1997 and various issues.

[13] See EIU's "Financing Operations in Singapore," 1997 and various issues.

[14] See EIU's "Financing Operations in Australia," 1997 and various issues.

flows.[15] Thailand freed inward capital flows in the early 1970s, but strict controls have traditionally applied to capital outflows. Only in the 1990s have the restrictions on capital outflows been loosened.[16] In Thailand, however, regulatory barriers to capital mobility were dismantled quite quickly.

Korea and Taiwan began financial deregulation relatively late and substantial barriers to international capital mobility still remain, especially in Korea. Taiwan traditionally has restricted capital outflows and did not eliminate controls on current account transactions until 1987. However, significant progress has been made since 1989 in liberalizing capital inflows and outflows in Taiwan.[17]

Although Korea started its financial liberalization process in 1981-1983, government controls remain a general feature of its international financial transactions. In the late 1980s, capital outflows, for example the liberalization of foreign direct investment and overseas investment by residents, were implemented.[18]

---

[15] See EIU's "Financing Operations in Japan," 1997 and various issues.

[16] See EIU's "Financing Operation in Thailand," 1997 and various issues.

[17] See EIU's "Financing Operations in Taiwan," 1997 and various issues.

[18] See EIU's "Financing Operations in Korea," 1997 and various issues.

(II) Exchange Rate Arrangements

In an open economy the foreign exchange market is an essential link in the financial system. During the 1980s, together with the deregulation of capital controls, most Asia-Pacific countries relaxed exchange controls and moved towards more flexible exchange rate arrangements.

As far as stock market integration is concerned, it is relevant to discuss the issue of exchange rate arrangements in the liberalization process since capital flows between different stock exchanges involve foreign exchange transactions. In other words, exchange rate flexibility may introduce uncertainty that could discourage or encourage speculative inflows.[19] In addition, the monetary authorities, under more flexible exchange rate arrangements, have a greater degree of independence in controlling the monetary aggregates.[20]

This section, therefore, highlights some of the important policy changes regarding exchange controls and arrangements in Asia-Pacific countries, as well as providing a discussion on current exchange controls and arrangements in each individual country. A summary of exchange rate arrangements in Asian-Pacific countries is presented in Table 1.3.2.1-2.

---

[19] See IMF's *International Capital Markets: Developments, Prospects, and Key Policy Issues*, 1995.

[20] In contrast, one may argue that exchange rate flexibility may have negative effects on the real exchange rate which, in turn, may impose a substantial adjustment burden on the economy

Table 1.3.2.1-2 Summary of Exchange Rate Arrangements

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985 - 1989	1990 -1997
Australia	PGC	MF	MF	MF	MF	MF	MF	MF	MF	IF	IF	IF
Hong Kong	IF	IF	IF	IF	IF	IF	IF	IF	US$	US$	US$	US$
Japan	MF	MF	MF	MF	MF	MF	MF	MF	MF	IF	IF	IF
Korea	US$	US$	US$	US$	US$	MF	MF	MF	MF	MF	MF	NMF
Malaysia	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF
Singapore	PGC	PGC	PGC	PGC	MF	MF	MF	MF	MF	MF	MF	MF
Taiwan	US$	US$	US$	US$	MF	MF	MF	MF	MF	MF	MF	MF
Thailand	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	PGC	PGC

Key:

US$: Pegged to US Dollar
PGC: Pegged to Composite
IF: Independently Floating
MF: Managed Floating
NMF: New Managed Floating

Most Asia-Pacific countries have deregulated their exchange controls and accompanied this deregulation with a movement toward greater flexibility in exchange rates. Hong Kong virtually abolished its exchange controls as early as December 1972. In November 1974 the Hong Kong dollar was allowed to float freely. However, since October 1983, the Hong Kong dollar has been pegged to the US dollar, the intervention currency, at the rate of HK$ 7.8 per US$ 1.[21]

In Malaysia, the ringgit has been allowed to float since 1973. Technically, the Bank Negara Malaysia (BNM) monitors the exchange rate against a weighted basket of currencies of its major trading partners, and intervenes only to maintain orderly

[21] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Hong Kong," various issues.

market conditions. There are no foreign exchange controls in Malaysia.[22] Currently the exchange rate of the Singaporean dollar is determined freely in the foreign exchange market. Historically, the Singapore dollar was pegged to a trade-weighted basket of currencies since 1975. In June 1978, Singapore completely liberalized foreign exchange transactions: residents are free to make transactions in any currency as well as to invest in any currency.[23] Australia abolished almost all foreign exchange controls in December 1983, while at the same time moving to a floating rate regime.[24] [25] Thailand has relatively low exchange controls. Since November 1984 the value of the Baht has been pegged on the basis of an undisclosed, weighted basket of currencies of Thailand's major trading partners.[26]

Japan liberalized its foreign exchange controls under a new foreign exchange law in December 1980. After the Yen/Dollar agreement with the United States in 1984, the yen's price is determined on the basis of supply and demand. Technically speaking, the Japanese authorities use the US dollar as currency to intervene, if necessary, in

---

[22] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Malaysia," various issues.

[23] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Singapore," various issues.

[24] There is no official rate for Australian dollar, however, an indicative rate which is based on market observation at 4 pm daily is published by the Reserve Bank of Australia.

[25] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Australia," various issues.

[26] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Thailand," various issues.

order to maintain orderly market conditions and to avoid excessive fluctuations in the value of the yen.[27]

Historically, the Korean won changed from being pegged to the US dollar to a managed float in January 1980. From the beginning of 1987, the Korean government has progressively deregulated foreign exchange transactions. In March 1990, the government introduced a new market-average exchange rate system under which the exchange rate floats subject to limits on daily movements of +/- 2.25%.[28] However, foreign exchange transactions have remained greatly restricted in Korea.[29] In December 1978, under the Foreign Exchange Regulation, residents of Taiwan were permitted to hold foreign exchange deposits; and to buy and sell foreign exchange at designated banks. In February 1979, the exchange rate in Taiwan was allowed to float within limits.[30]

---

[27] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Japan," various issues.

[28] See International Monetary Fund's *Annual Report* on "Exchange Arrangements and Exchange Restrictions: Korea," various issues.

[29] The Korean government declared its intention to lift foreign exchange controls when it acceded to the obligations of an Article VIII country of the IMF Agreements in November 1988.

[30] See Central Bank of China,Taiwan's *Annual Report*, and various issues.

(III) Liberalization of interest rates

Prior to the 1980s, interest rate restrictions throughout the Asia-Pacific region took the form of ceilings on the deposit and loan rates of commercial banks.[31] These restrictions led to the rise of unregulated financial markets and nonbank institutions in the region as savers and investors sought alternative channels outside the formal financial system.

Theoretically, one of the major objectives of interest rate liberalization is to raise real interest rates, only thereby encourage efficient investment. This, then, may contribute to higher economic growth.[32] By stimulating the formal banking sector instead of informal institutions, positive real interest rates can restore the effectiveness of monetary policy.

Interest rate liberalization was a major feature of the financial reforms implemented by nearly all the Asia-Pacific countries. Nevertheless, the degree and timing of interest rate liberalization has varied from country to country. Several countries in the Asia-Pacific region, for instance, Australia, Hong Kong, Malaysia and Singapore, have carried out extensive interest rate deregulation. On the contrary, other countries, such as Japan, have adopted a gradual approach to liberalization. A summary of interest rate liberalization in Asian-Pacific countries is presented in Table

[31] Note that nonbank financial institutions were usually subjected to fewer restrictions.

[32] See McKinnon (1991).

1.3.2.1-3.

Table 1.3.2.1-3 Summary of Interest rate Liberalization

	1970	1971	1972 - 1974	1975 - 1979	1980	1981 - 1987	1988	1989	1990	1991	1992	1993 -1997
Australia	x	x	^	^	o	o	o	o	o	o	o	o
Hong Kong	^	^	^	^	o	o	o	o	o	o	o	o
Japan	*	*	*	x	x	x	x/^	x/^	x/^	^	^	^
Korea	*	*	*	*	*	*/x	x	x	x	x/^	x/^	x/^
Malaysia	*	*	*	*	x	^	o	o	o	o	o	o
Singapore	^	^	^	o	o	o	o	o	o	o	o	o
Taiwan	*	*	*	*	*/x	*/x	x	x/^	x/^	x/^	x/^	x/^
Thailand	*	*	*	*	x	x	x	^	^	^	^	^

Key:

* Heavy Restrictions
x Moderate Restrictions
^ Mild Restrictions
o No Restrictions

Details of each individual country are as follows. In Australia, interest rate restrictions werelifted on large overdrafts in 1972 and on large Certificates of Deposits (CDs) in 1973. As well, since the beginning of the 1980s, interest rate ceilings on deposits and loans have been relaxed rapidly. Currently a ceiling exists only on small bank loan rates while deposit rates are free of controls.[33]

Hong Kong and Singapore have adopted a more distinct form of interest rate liberalization. Indeed, formal interest rate controls no longer exist in either country, as both have decided to become international financial centers. In Singapore, restrictions on bank rates were removed in July 1975. Since then it has maintained interest rates

[33] See Reserve Bank of Australia's *Australian Economic Statistics* and *Bulletin*, various issues. Also see EIU's *Country report: Australia*, various issues.

which closely follow international interest rates by using money market instruments.[34] Similarly, Hong Kong also very frequently adjusts its deposit rates in order to keep the rates in line with other financial centres, and to maintain orderly market conditions.[35]

Since October 1978 Malaysia has allowed financial institutions to set deposit and lending rates, hence, interest rates in Malaysia were moved toward a more flexible regime. In addition, the pegging of deposit rates to those of two lead banks was discontinued in 1987. Currently, interest rates are determined quite freely by market forces, with the exception of loans to priority sectors.[36]

The Japanese authorities, prior to the start of financial reform, regulated deposit rates for all institutions. The only two major exceptions of regulated interest rates were rates determined in the gensaki[37] and interbank markets.[38] Since the late 1970s the Japanese authorities have allowed several new financial instruments with market-determined interest rates, including negotiable certificates of deposit and money market certificates. In the early 1990s, Japan explicitly adopted a gradual approach to liberalize its interest rate[39]. Currently, the majority of deposit rates remain constrained

---

[34] See Bank of Singapore's *Annual Report*, various issues. Also see EIU's *Country report: Singapore*, various issues.

[35] See EIU's *Country report: Hong Kong*, various issues.

[36] See Bank Negara Malaysia's's *Annual Report*, and EIU's *Country report: Malaysia*, various issues.

[37] The Ministry of Finance officially recognized the gensaki market in 1976.

[38] Although lending rates were not set officially, they were in fact regulated.

[39] See Bank of Japan's *Annual Report*, various issues. Also see EIU's *Country report: Japan*, various issues.

and lending rates are still indirectly tied to the Bank of Japan's discount rate.

Other countries, such as Thailand, Korea and Taiwan, have even been much more reluctant to reduce interest rate controls. In Thailand, the liberalization of interest rates occurred in the early 1980s. First, the lending rates of financial institutions were freed in 1984. Then, in June 1989, the ceiling on deposit rates was lifted. Currently, nonbank financial institutions in Thailand have been allowed to develop relatively openly.[40]

Korea started its interest rate liberalization in June 1981. It started by reducing the differential between general bank loan rates and preferential loan rates, and hence it allowed banks to vary lending rates within margins. Another major step was taken in December 1988 when lending rates, rates on deposits and money market instruments were liberalized. Eventually, in August 1991, Korea set up the "four stage interest rate deregulation plan" to complete its interest rate liberalization in a very cautious manner to avoid any possible disorder.[41]

Taiwan began to liberalize its controls on interest rates from April 1980 when official restrictions on bank lending rates were lifted. Then, in March 1985, its lending rate was completely liberalized and another significant step occurred in January 1986

---

[40] See Bank of Thailand's *Annual Report*, various issues. Also see EIU's *Country report: Thailand*, various issues.

[41] See Bank of Korea's *Annual Report* and *Financial System in Korea*, various issues. Also see EIU's *Country report: Korea*, various issues.

when the Central Bank reduced the categories of deposit rate ceilings. Hence, this phase allowed both local and foreign banks to set their own deposit and lending rates freely according to their funding costs. Finally, the New Bank Act 1989, erased the remaining regulations controlling maximum deposit rates and maximum and minimum loan rates.[42]

[42] See Central Bank of China, Taiwan's *Annual Report*, various issues; and Council for Economic Planning and Development, Taiwan's *Taiwan Statistical Data Book*, various issues. Also see EIU's *Country report: Taiwan*, various issues.

1.3.2.2 Stock Market Internationalization

One of the most significant stock market developments of the 1980s and 1990s has been the gradual opening and remarkable expansion of Asia-Pacific stock markets. This can be attributed to the large equity portfolio inflows, due to positive valuations of the development potential of the region by investors, the accomplishment of a variety of reform programs designed to encourage the region's stock markets and the outcome of continuing economic growth in all the countries concerned.[43] In view of the important role of the stock market, the governments of Asia-Pacific countries in the past two decades or so have set up the fundamental institutional framework and directed their effort towards the efficient development of their stock markets. The primary objective of this section is to look at the current status, regarding foreign investment activities, of financial reform in the development of Asia-Pacific stock markets. Hence, this review puts an emphasis on barriers to equity portfolio flows. These barriers to equity portfolio flows can be classified into: (1) direct barriers; and (2) indirect barriers.

This section first discusses the recent trend of capital flows into the Asia-Pacific region. Then it looks at the current position regarding direct and indirect barriers to equity mobility in the region.

---

[43] A series of articles in the World Bank investigated the effect of stock markets on economic growth, and government policies to foster the development of stock markets. For details, see the May 1996 issue of the *World Bank Economic Review.*

(I) Net Capital Flows in the Asia-Pacific Region

With increasing global connections, improving communications networks, and advancements in information technology, net portfolio flows to Asia-Pacific countries in the 1990s have reached their highest level (see table 1.3.2.2-1). The scale of the capital inflows into the region and other emerging markets provide confirmation that the 1990s represent a trend toward greater global financial market interdependence.[44]

Table 1.3.2.2-1 Net Inflows to Emerging Asia, 1977 - 1997, (US dollars in billions)

	Annual Average									
	1977-1982	1983-1989	1990	1991	1992	1993	1994	1995	1996	1997
Net Portfolio Flows	0.6	1.4	-0.4	3.1	7.4	23.9	18.5	20.1	20.1	na
Net Equity Flows	—	----	3.89	4.73	10.95	30	na	na	na	na
Net Capital Flows	----	----	—	----	----	----	106	135	150	90

Source: *World Economic Outlook* data base, IMF, for net portfolio and net equity flows; and *World Financial Markets*, JPMorgan, for net capital flows.

Table 1.3.2.2-1 highlights net capital flows[45] into Asia-Pacific countries[46] over the period 1977 to 1997. While portfolio flows were insignificant during the 1970s

[44] Although falls in capital inflows occurred during the two crisis periods of 1994 for Latin America and 1997 for Asia-Pacific, the capital inflows to Asia-Pacific countries, if compared to the period prior to the 1990s, remain strong throughout its stock market crisis. (See table 1.3.2.2-1).

[45] Net portfolio flows are defined by the World Bank as total cross-border portfolio purchases less total cross-border portfolio sales, and they are calculated as inflows into various national stock markets.

[46] Also known as Emerging Asia countries, for a definition of emerging markets, see International Finance Corporation's publication: *Emerging Markets Factbook.*

and 1980s, they became sizable in the early 1990s. A noticeable fact is that in 1993 net portfolio inflows into the region, excluding Japan and Australia, hit an astonishing US$ 23.8 billion.[47]

Importantly, portfolio flows had reached US$ 20.1 billion in 1996, or 20 times larger than their 1990 total, and hence, represented the largest component of flows between 1992 and 1996 in the Asia-Pacific region. In addition, since the 1980s attracting foreign portfolio investment became one of the prime goals throughout the Asian-Pacific region as a crucial factor in ensuring an adequate supply of capital for long-term growth.

Another way to look at portfolio flows is to discuss and analyze some fundamental data of stock markets in the region, namely: market capitalization; turnover ratio; P/E ratio; and dividend yield. As shown in table 1.3.2.2-2, the combined market capitalization of the seven Asia-Pacific stock markets (Australia, Hong Kong, Korea, Malaysia, Singapore, Taiwan and Thailand) excluding Japan, increased from about US$ 283,283 million in 1987 to US$ 1,731,016 million by end-1996, a sixfold increase. Yet, most strikingly, the region's market capitalization fell spectacularly in 1997.

[47] In additional, overall net equity inflows in 1993, including Japan (US$ 20 billion) and Australia (US$ 2 billion), in emerging Asia were US$ 52 billion.

Table 1.3.2.2-2 Asia-Pacific Stock Markets Capitalization, 1987 - 1996 (US$ millions)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Australia	105,709	138,283	140,956	107,611	144,867	135,451	203,964	219,188	245,218	311,988
Hong Kong	54,088	74,377	77,496	83,397	121,986	172,106	385,247	269,508	303,705	449,318
Korea	32,905	94,238	140,946	110,594	96,373	107,448	139,420	191,778	181,955	138,817
Malaysia	18,531	23,318	39,842	48,611	58,627	94,004	220,328	199,276	222,729	307,179
Singapore	17,931	24,049	35,925	34,308	47,637	48,818	132,742	134,516	148,004	150,215
Taiwan	48,634	120,017	237,012	100,710	124,864	101,124	195,198	247,325	187,206	273,608
Thailand	5,485	8,811	25,648	23,896	35,815	58,259	130,510	131,479	141,507	99,828
Sub-Total	283,283	483,039	697,825	509,127	594,354	717,210	1,287,409	1,393,070	1,430,324	1,731,016
Japan	2,802,952	3,906,680	4,392,597	2,917,679	3,130,863	2,399,004	2,999,756	3,719,914	3,667,292	3,088,850
Total	3,086,235	4,389,773	5,090,422	3,426,806	3,725,217	3,116,214	4,287,165	5,112,984	5,097,616	4,819,866

Source: Emerging Stock Markets Fact Book, various issues, IFC.

As shown in table 1.3.2.2-3, Asia-Pacific equities, excluding Taiwan, lost 51% of their value (in dollar terms) in 1997. The crisis in the region led to a fall in portfolio flows globally.[48] Nevertheless, as compared to before 1990, portfolio inflows to Asia-Pacific countries remained strong throughout the crisis. Assuming that the expansion in market capitalization will continue, despite the 1997 crisis, and if only 10%[49] of this were to come from foreign investors, the scale of capital inflows in the Asia-Pacific region will continue and even increase.

Table 1.3.2.2-3 Equity Market Changes in 1997 (end-1997 compared to end-1996)

	Hong Kong (Hang Seng)	Japan (Nikkei)	Korea (Kospi)	Malaysia (Composite)	Singapore (Straits Time)	Taiwan (Wighted)	Thailand (SET)
% Change In local currency	-20.3	-21.2	-42.4	-52	-31	18.1	-55.2
% Change In US Dollar Terms	-20.4	-30.1	-71.2	-68.7	-42.5	-0.5	-76.1

Source: World Financial Markets, JPMorgan, 02/01/1998.

Alternative measures of foreign equity flows are the price-earnings (P/E) ratio and dividend yield. As shown in table 1.3.2.2-4, P/E ratios in most of the Asia-Pacific stock markets are quite high compared to those in developed markets, such as the US (15.5), and have been increasing in recent years. Some studies[50] point out that the P/E

[48] Total net portfolio inflows to emerging economies in 1997 dropped from US$ 26 billion to US$ 20 billion. (See JP Morgan's *World Financial Markets*, January 1998 issue.)

[49] According to Howell (1994), just over 9% of all quoted stocks worldwide are today in the hands of foreign investors and he suggests that this proportion should ultimately rise to somewhere between 10% to 15%.

[50] Such as Buckberg (1992)

ratio typically increases substantially once a market is opened to foreign investment, and at the same time "openness" would result in lower dividend yields. The high P/E ratios in Asia-Pacific stock markets may indicate that these countries have experienced high equity inflows.

Table 1.3.2.2-4 Market Size; Turnover Ratio and Rank; P/E Ratio; and Dividend Yield

	Toatal market capitalization (US$ Millions)	(Market Share)	Turnover Ratio	Rank	P / E Ratio	Dividend Yield(%)
Austrlia	311,988	6.47%	52.2	22	14.79	4.01
Hong Kong	449,318	9.32%	44.2	25	10.73	4.13
Japan	3,088,850	64.09%	37.1	32	90.3	0.68
Korea	138,817	2.88%	110.5	7	21.8	1.2
Malaysia	307,179	6.37%	65.5	15	28.5	1.58
Singapore	150,215	3.12%	28.7	38	21	1.7
Taiwan	273,608	5.68%	204.1	2	33.5	2.2
Thailand	99,828	2.07%	36.8	33	19.51	1.86
Total	4,819,803	100%				

Source: *Emerging Stock Markets Fact Book*, IFC, 1997, for market size and turnover ratio; and *The Guild to World Equity Markets*, Euromoney, 1995, for P/E ratio and dividend yield.

Table 1.3.2.2-4 shows that the turnover ratio tends to be relatively high for all Asian-Pacific markets' stocks. In fact, all of the eight Asia-Pacific stock markets are listed in the 1996 IFC Top 40 markets by turnover rations. This is especially true for Taiwan (which has a turnover ratio of 204.1) and Korea (which has a turnover ratio of 110.5). Theoretically, the turnover ratio is a measure of trading activity, involving gross flows which are defined as the sum of equity purchases and sales. The turnover ratio is often used as an indicator of markets' liquidity; high liquidity allows investors

to alter their portfolios quickly and cheaply, it makes investment less risky and improves the mobility of portfolio investment.

According to the above discussion of Asia-Pacific data, there exists some evidence of high prospects for increasing equity flows into the region. However, some arguments have arisen. Firstly, P/E ratios have been used as a method of calculating whether a stock is over-priced or under-priced. Therefore, the high P/E ratios in Asia-Pacific stock markets may also suggest that most of the prices of stocks were overvalued. The high P/E ratios in Asia-Pacific stock markets may, in turn, cause unstable portfolio flows into the region.

Secondly, the high turnover ratios also warrant discussion. A high turnover ratio symbolizes the high volatility which may be attributed to the highly speculative activities in Asia-Pacific stock markets. Therefore, equity inflows may reflect one-off changes to portfolio structure activated by international investors wishing to diversify. If this is the case for high turnover ratios among Asia-Pacific markets, then, the capital inflows in these markets may be short-lived and very volatile. Again, as capital markets are liberalized, volatility will be affected to a greater extent by global factors relative to local factors.

Finally, in the wake of the 1990s surge of portfolio investment flows an important question has arisen: Will international investment funds continue to flow into Asia-Pacific markets? Although the Asia-Pacific region as a whole remained the

largest recipient of capital flows in 1996,[51] the expansion of capital flows has experienced a slowdown, especially in 1997.[52] The relatively modest expansion of capital flows to Asia-Pacific countries reflected the impact of a slowdown in export growth rates; current account deficits;[53] political tensions; some speculative currency attacks; as well as the uncertainties created by financial sector weaknesses.

Yet, the link between capital flows and quality of policy and economic performance of Asia-Pacific countries brought an important message. That is: in order for Asia-Pacific countries to encourage a sustained portfolio investment inflow, rather than short-term speculative movements of funds, they have to establish appropriate domestic institutional frameworks.

[51] Note that in 1996, net capital inflows in Emerging Asia were US$ 150 billion; in Latin America US$ 82 billion; and other emerging economies US$ 55 billion. (see January 1998 issue of JP Morgan's *World Financial Markets*)

[52] The net capital inflows to Emerging Asia declined to US$ 90 billion in 1997. (see table 1.2-4)

[53] For example, in 1997, current accounts were negative in Korea (US$ -8.7 billion), Malaysia (US$ -4.5 billion), and Thailand (US$ -11.7 billion).

(II) Barriers to Equity Portfolio Flows

Whether the inflows of portfolio investment will continue depends very much upon the degree and pace of market internationalization in the region. Indeed, most of the reform programs are involved in areas such as improving legal and regulatory frameworks, promoting competition, and the elimination of barriers to equity portfolio flows. Such reforms, it is believed, may help to reduce the cost of capital; improve the operation of domestic stock markets and support policymakers in their efforts to reassert domestic monetary control.

An important measure of the openness that stock markets in the Asia-Pacific region have achieved hitherto can be examined in terms of market integration. Preliminary investigation of integration and openness requires an investigation of barriers to portfolio mobility. With lower barriers, stock markets can be expected to be more integrated. Although Asia-Pacific countries in recent years have demonstrated their willingness to open their economies to external investment, investors from abroad still face some restrictions when investing in the region.

This section examines the current restrictions in Asia-Pacific stock markets which can be classified as either: (A) *direct barriers*: foreign ownership restrictions, and withholding tax rates for foreign investors; and (B) *indirect barriers*: availability of information, quality of accounting standards, investor protection and transaction and other costs.

(A) Direct Barriers

Direct barriers can be defined as differences in the judicial status of domestic and foreign investors. Direct barriers can take the form of: (a) restrictions on foreign ownership of domestic securities, and (b) discriminatory tax regulations.

(a) Foreign Ownership

The eight Asia-Pacific countries may be classified, depending upon the degree of government control over foreign ownership, into four categories: (i) no restrictions; (ii) open with few limitations; (iii) substantially liberalized but not completely open; and (iv) "semi-closed". The current situation in each category is summarized in table 1.3.2.2-5.

Table 1.3.2.2-5 Foreign Ownership, 1997.

		Restriction on Foreign Ownership
Category 1	Hong Kong	No restriction
Category 2	Singapore	No restriction with exception on selected industries
	Japan	No restriction except industries in "national interest"
Category 3	Thailand	Restriction on more than 49% of shares
	Australia	Restriction on ownership more than 15% of shares
	Malaysia	Restriction on more than RM 5 million or 15% or voting power
Category 4	Taiwan	Limits on selected industries and 10% of company shares and 5% individual holding
	Korea	Limits on selected industries and 12% of company shares and 3% individual holding

Source: *Financial Foreign Operations*, EIU, 1997;and *Emerging Stock Market Fact Book*, IFC, 1997.

As in table 1.3.2.2-5, the only market in category 1 is Hong Kong. There are no restrictions regarding ownership of domestic securities by foreigners on the Hong Kong stock exchange.[54]

The stock markets in category 2, such as Singapore and Japan, are fully liberalized except for restrictions on selective industries or companies justified as being in the "national interest." In Singapore, buying and selling securities are not subject to any general limitations, but restrictions apply to transactions in banking stocks and certain strategic companies.[55] Although restrictions on foreign ownership in Japan have been significantly lifted, specific restrictions still exist. They apply to foreign acquisition of stocks in any company in industries such as aircraft, arms, atomic energy and other industries relating to national security and natural resources.[56]

Australia, Malaysia and Thailand are in the third category where foreign ownership of domestic companies is limited to a fixed percentage of the shares outstanding or of voting rights. In Australia, the restrictions on foreign ownership come into effect when the holding is more than 15% of the issued shares or voting power of a company or represents a total value of more than A$ 50 million.[57] In Thailand, generally, foreign ownership of any company is limited to 49% of its

---

[54] See IMF's "Exchange Agreements and Exchange Restrictions: Hong Kong," 1996 and various issues.

[55] See IMF's "Exchange Agreements and Exchange Restrictions: Singapore," 1996 and various issues.

[56] See IMF's "Exchange Agreements and Exchange Restrictions: Japan," 1996 and various issues.

[57] See IMF's "Exchange Agreements and Exchange Restrictions: Australia," 1996 and various issues.

capital.[58] But, foreign ownership of banks and finance companies is limited to 25% of their capital.[59] In Malaysia, the prior approval of the Foreign Investment Committee is required for foreign acquisition of investments exceeding RM 5 million in value or the equivalent of 15% or more of voting power in a Malaysian company.[60]

Korea and Taiwan are in the last category which indicates that foreign ownership is severely restricted although markets are in the process of being opened. In Taiwan, foreign investors face a total foreign investment quota of US$ 5 billion and an investment ceiling of US$ 100 million per foreign institutional investor. Applications to exceed this limit are reviewed on a case-by-case basis. In addition, total foreign ownership of a company is restricted to 10% and foreign investors cannot exceed a 5% limit on holdings of any one company's stock.[61] In Korea, foreign ownership in most individual companies is limited to 12% of aggregate value or 3% per individual investor. However, approvals of foreign ownership are not granted for certain sectors, particularly state monopolies, such as tobacco and ginseng, and other government-

---

[58] However, it can be further reduced by a company's own memorandum or articles of association.

[59] Note that in Thailand, foreign investors can buy "local shares," but they are not entitled to dividends, rights offerings, or proxy voting of them. See IMF's "Exchange Agreements and Exchange Restrictions: Thailand," 1996 and various issues.

60 In Malaysia, there is no law restricting the percentage of foreign ownership. Nevertheless, guidelines issued by the Foreign Investment Committee, a government policy-making committee, are not law but they are invariably adhered to. See IMF's "Exchange Agreements and Exchange Restrictions: Malaysia," 1996 and various issues.

[61] In Taiwan foreign ownership is not limited in the cases of foreign institutional investors purchasing unlisted, open-ended unit trusts. See IMF's "Exchange Agreements and Exchange Restrictions: Taiwan," 1996 and various issues.

own sectors, such as utilities.[62]

Overall, most restrictions on foreign ownership in Asia-Pacific range between 3% (Korea) and 49% (Thailand). Seven out of eight Asia-Pacific countries in this study, except Hong Kong, have limited (for example: Australia, Malaysia, and Thailand) or totally restricted (for example: Japan, Singapore, Korea, and Taiwan) foreign ownership in selected industries. In addition, in both Korea and Taiwan foreign investors face severe restrictions and do not have direct access to local equity markets.

(b) Withholding Tax Rates

Taxation has often been considered as a tool to implement change proactively in stock markets, either being used to encourage a market sector[63] or to slow down overheated markets[64]. It is believed that a low tax policy in relation to stock markets may attract increasing portfolio flows. The withholding tax rates on interest, dividends, and capital gains that the Asia-Pacific countries currently impose on foreign investors are presented in table 1.3.2.2-6.

---

[62] Foreign investment in Korea currently is allowed in some 88% of the 1,148 business sectors listed in the standard industrial classification. See IMF's "Exchange Agreements and Exchange Restrictions: Korea," 1996 and various issues.

[63] For example, liberalizing the tax on interest income.

[64] For example, introducing capital gains on stock profits.

Table 1.3.2.2-6 Withholding Tax Rates for Foreign Investors, 1997

		Interest	Dividend	Capital Gain
		(%)	(%)	(%)
Australia	foreign investors:	10%	30%	0%
	treaty investores:	10%	15%-25%	
Hong Kong	foreign investors:	0%	0%	0%
Japan	foreign investors:	20%	20%	0%
	treaty investores:	0%-20%	0%-20%	
Korea	foreign investors:	27%	27.00%	0%
	treaty investores:	0%-16%	5%-27%	
Malaysia	foreign investors:	20%	0%	0%
SIngapore	foreign investors:	33%	0%	0%
Taiwan	foreign investors:	20%	20%	0%
Thailand	foreign investors:	15%	10%	15%
	treaty investores:	10%-15%	10%	

Source: *Financial Foreign Operations*, EIU, 1997;and
Emerging Stock Markets Fact Book, IFC, 1997.

Hong Kong[65] does not impose any withholding tax on foreign portfolio investment and there are no capital gains withholding tax rates. Both Singapore[66] and Malaysia[67] impose only a withholding tax on interest. Hence, most of the Asia-Pacific

[65] Foreign investment in Korea currently is allowed in some 88% of the 1,148 business sectors listed in the standard industrial classification. See IMF's "Exchange Agreements and Exchange Restrictions: Korea," 1996 and various issues.

[65] For example, liberalizing the tax on interest income.

[65] For example, introducing capital gains on stock profits.

[65] See EIU (1997), "Financing Operations in Hong Kong."

[66] See EIU (1997), "Financing Operations in Singapore."

[67] See EIU (1997), "Financing Operations in Malaysia."

countries do not impose capital gains on foreign investors from normal portfolio investment operations, except Thailand where a 15% tax is imposed.

Lower withholding taxes on dividend and interest are applicable under bilateral tax treaties in Australia,[68] Japan,[69] Korea[70] and Thailand.[71] Nevertheless, Taiwan[72] is the only country that does not have any bilateral tax treaty and which imposes withholding taxes on both dividend and interest.

---

[68] See EIU (1997), "Financing Operations in Australia."

[69] See EIU (1997), "Financing Operations in Japan."

[70] See EIU (1997), "Financing Operations in Korea."

[71] See EIU (1997), "Financing Operations in Thailand."

[72] See EIU (1997), "Financing Operations in Taiwan."

(B) Indirect Barriers

Indirect barriers are related to the extent of "development" of the stock markets. Although indirect barriers are difficult to quantify, they can be represented by indicators of market development as availability of information, the quality of accounting standards, investor protection and transaction and other costs. Table 1.3.2.2-7 presents indicators relating to each of those factors.

Table 1.3.2.2-7 Indirect Barriers, 1997

	Regular Publication of P/E,yield	International Electronic Coverage*	Annual (Interim) Financial Disclosure Requirements	Accounting Standards	Investor Potection	Transaction Cost etc.**
Australia	C	Yes	Yes (S)	Good	Good	{ 1 }
Hong Kong	C	Yes	Yes (S)	Good	Good	{ 5 }
Japan	C	Yes	Yes (S)	Good	Good	{ 3 }
Korea	C	Yes	Yes (S)	Good	Good	{ 6 }
Malaysia	C	Yes	Yes (S)	Good	Good	{ 2 }
Singapore	C	Yes	Yes (S)	Good	Good	{ 4 }
Taiwan	C	Yes	Yes (Q)	Adequate	Adequate	{ 8 }
Thailaind	C	Yes	Yes (Q)	Adequate	Adequate	{ 7 }

Note: C = comprehensive and published internationally
S = semiannually published
Q = quarterly published
* = daily coverage of stock market on an international wire service
** = including stamp taxes, exchange taxes, registration fees, etc.

Source: *Financial Foreign Operations*, EIU, 1997; and *Emerging Stock Market Fact Book*, IFC, 1997.

To achieve a fair and orderly stock market, the SEC in all Asia-Pacific countries generally requires each listed company to take reasonable steps to ensure that all who invest in its securities have equal access to that information. Therefore, all listed companies, as required by the authorities, have to provide investors with regular comprehensive information about their businesses. Table 1.3.2.2-7 shows that most

information is published regularly and is available to the investor.

The SEC in each Asia-Pacific stock market also imposes continuous disclosure obligations and requires timely disclosure of any information likely to materially affect the price or value of the company's securities.[73] Hence, notice must also be given of various corporate decisions or resolutions such as the issuing of new shares, capital reduction, mergers, dividends, stock splits, variations of class rights and any other matter of importance with regard to the rights or privileges attached to its securities. As far as accounting standards and investor protection are concerned, most Asia-Pacific stock markets have reached an internationally acceptable quality. (See Table 1.3.2.2-7) The only exceptions are Taiwan and Thailand which have been classified as being at the adequate level.[74] Transaction and other costs, such as stamp taxes, registration fees, commissions, etc., are included to rank the cost of the stock markets.[75] Australia and Malaysia are the most costly, while Taiwan is the least costly. Low transaction and other costs in Taiwan explain why the Taiwan Stock Exchange is one of the busiest in the world. Investors in Thailand and Korea also enjoy relatively low transaction costs.

---

[73] The availability of information is examined, according to the IFC, in term of stock exchange publications, international electronic coverage, annual financial disclosure requirements, and interim financial disclosure requirements.

[74] The evaluation here is based on the information provided in the IFC's *Emerging Stock Markets Factbook.*

[75] Transaction costs, etc. is calculated and ranked by estimate of the total investment of US$ 10,000, hence, the higher the total cost is, the lower is the rank.

Chapter 2 Stock Market Linkages and Pricing: A Review of the Literature

2.1 Introduction

The recent literature on finance has seen an enormous increase of interest in the activity and role of the world's stock markets, particularly regarding stock price movements. Most of the existing literature examines and discusses such issues as: the international causes of stock market crashes, like those which occurred in 1987 and 1997; the effects of the relaxation of capital controls, such as the abolition of U. K. exchange controls in 1979; the applicability of asset pricing models, such as the CAPM and the APT models; and the globalization of financial markets.

This chapter reviews the literature on stock price series from two major sets of studies:

(1) studies which examined the impact of foreign stock markets on the domestic stock market; and (2) studies which investigated the impact of domestic macroeconomics fundamentals on the domestic stock market. These are two of the major factors that may have had an impact on domestic stock returns.

This chapter also discusses and compares the results from tests using different statistical techniques (e. g. correlation, unit root and cointegration, vector autoregression, causality tests, etc.); different frequency data (e.g. daily or monthly); and different region (e.g. Europe, US and Asia). In addition, one of the theoretical arguments in the literature

on international stock markets starts with the question of stock market efficiency. The evidence is controversial: some studies support the notion of stock market efficiency while others do not. The diverse outcomes hinge critically upon the definition of market efficiency (Granger, 1986; Dwyer and Wallace, 1992). Thus, to provide the background for this research, this chapter also reviews some articles which test the market efficiency hypothesis (MEH).

Furthermore, the earlier literature on the Asia-Pacific region includes the price/earning ratio effect[76], and the day-of-week pattern of daily stock returns[77]. The recent literature moves beyond these topics to address the issues of market integration and the effects of fundamentals on the stock market. This new set of studies broadens the range of research topics and is an encouraging development in the research on Asia-Pacific stock markets. Thus, the particular interest in this chapter is to discuss the newer set of studies.

[76] See, such as Rhee, Chang, and Ageloff (1990).

[77] See, such as Lee, Pettit, and Swankoski (1990).

2.2 The Impact of Foreign Stock Markets on the Domestic Stock Market

Observers generally agree that movements in the world's stock prices have become closer in the past decade. One of the original motivations for the study of such stock market 'integration' was the interest in the study of gains from international portfolio diversification[78]. The benefits of international diversification are inversely related to the extent of integration between these stock markets. Another influential factor has been the worldwide move to financial market deregulation in the past decade that has potentially enhanced the co-movement among national stock markets[79]. Thus, this apparent increasing integration among national stock markets led to the argument that the behavior of the crash in October 1987 was influenced by international events to a greater extent than had been expected[80].

This section reviews some articles which examine issues related to the following two themes. One is the co-movement of returns in distinct stock markets. This theme, it brings together the discussion on several issues such as: international diversification, 1987 crash, deregulation and globalization and market integration. In addition, a considerable amount of work has been done on the issue of stock market co-movements, which, generally speaking, has used much earlier data sets, most of them before 1990. Hence, this theme can be identified as the earlier stage of study on market integration.

---

[78] See, for example, Grubel (1968).

[79] See, for example, Ma (1990).

[80] See Bennett and Kelleher (1988).

The second themes looks at the interdependencies of national stock market indices. The experience of the 1987 crash made people realize that various national stock markets had become so integrated that one market, such as the US market, may exert a strong influence on other national stock markets. Hence, various studies were undertaken which focused on the degree of inter-relatedness between national stock markets.

2.2.1 Co-movement of stock markets

The finance literature suggests that stock markets serve an important function in the financial system by mobilizing savings. Capital mobility enables stock markets to relocate resources from capital-surplus countries to capital-deficit ones. Hence, the seeming relaxation of capital controls in the past two decades has caught the attention of the researchers and policy-makers, as well as the private investors, and prompted them to question whether capital markets are integrated

The following sub-sections will examine the literature on stock market co-movement regarding such issues as: international portfolio diversification, the crash of 1987 and financial deregulation.

(I) International diversification

The early literature on international portfolio diversification can be identified as the early stage of study on market integration. It was based on estimates of correlation

coefficients between national stock markets[81]. The benefit of international risk-diversification of investment is well documented by Grubel (1968)[82], Levy and Sarnat (1970)[83], and Lessard (1973) [84]. These studies found that there are gains from international diversification. In addition, studies by Ripley (1973)[85], Panton, Lessig, and Joy (1976)[86], and Hilliard (1979)[87] applied more sophisticated methodologies to investigate the comovements of world stock markets. Despite different methodologies, these studies found evidence of co-movements among the world's stock markets. Although different results or implications are found in these early studies, since all

[81] The underlying idea of international portfolio diversification is that a greater range of alternative portfolios can be considered to make a trade-off between the risk and the rate of return associated with that portfolio. The opportunity exists for selecting a more attractive portfolio than if the investor was limited to one national stock exchange. In short, as long as stock returns in different stock markets are not highly correlated, investors in the domestic market will gain by diversify portfolios internationally.

[82] Grubel was the first to explore the risk-return relationships of internationally diversified portfolios. His results, among eleven countries for the period 1959-1966, indicated that international diversification of portfolios is the source of world welfare gains from international economic relations and hence would have allowed investors a better return-risk trade-off.

[83] Levy and Sarnat, which set out the mean rates of return and standard deviations of optimal portfolios for 28 countries for the period 1951 to 1967, found that risk reduction through international diversification is reflected in the continuous reduction of the portfolio variance as the opportunity set is broadened. Thus, they showed international diversification as a normative approach for investors.

[84] Lessard, using multivariate analysis for the period from December 1958 to December 1968 among a set of developing countries, showed that substantial gains are likely to result from multinational diversification within an IU (Investment Union) over investment in single countries.

[85] Ripley, using monthly stock price indices for 19 developed countries, investigates the major patterns of covariance between national indices. He found that the more open the stock market is to capital flows, the higher will be the covariance between that market and the markets in other countries.

[86] Using cluster analysis, the results from Panton, Lessig, and Joy's study (1976) indicated that relatively high degrees of similarity is found in some international markets.

[87] Hilliard, which examines the structure of international equity market indices during a world-wide financial crisis, applied cross-spectral methods to conclude that most intra-continental prices move simultaneously.

studies over different periods, this controversy may be, in fact, evidence that world stock markets have become more closely integrated.

(II) The crash of October 1987

Several studies have examined the co-movement of the world's stock markets before and after the 1987 crash. Dwyer and Hafer (1988) employed time series analysis to examine the co-movements of the stock markets in the US, the UK, West Germany, and Japan around the time of the 1987 crash. Their results showed co-movement among the markets they examined.

Another study by Meric and Meric (1997) applied correlation analysis to compare the relationships among eighteen stock markets before and after the crash. The authors concluded that national stock markets appeared to be more closely tied to one another after the 1987 crash than before it.

A study by Bennett and Kelleher (1988), on the other hand, argued that the October crash was qualitatively similar to prior episodes in that the volatility spread from market to market and correlations among some markets strengthened. Their study showed that stock price movements in major markets have become increasingly similar in the 1980s compared to the 1970s. However, they also showed that this increased similarity of price moves has been comparatively small and does not appear to have decisively influenced how markets interacted in October 1987. In short, their article presents evidence that the interactions among international stock price movements

during the October crash were in certain respects similar to the reactions of major markets to volatility in the past, and thud are not easily attributable in a direct sense to the trend toward integrated world stock markets.

Does examination of the causes and effects of the 1987 crash provide evidence of market integration? Most of the literature on the crash provides evidence that world stock prices did move more closely after the 1980s than they did in the 1970s and earlier.

(III) Financial deregulation

The trend towards market deregulation has lead to an increased focus on the greater integration of the world's capital markets. A considerable amount of work on this issue has employed time series analysis, particularly unit root tests and cointegration tests.

Consequently, tests for the existence of cointegration can also be interpreted as tests of market efficiency.[88] [89] The idea that cointegration has implications for financial market efficiency was introduced by Granger (1986). He first argued that if cointegration exists between two stock markets it suggests that one of the markets will help predict the other since a valid error correcting representation will exist, which is clearly inconsistent with the definition of weak efficiency according to which asset

[88] Note that this notion has recently been challenged by Dwyer and Wallace (1992).

[89] The implications on unit root and cointegration tests are: (1) if the null hypothesis of a unit root in a stock price series of a market is not rejected, the individual market is weak-form efficient, and (2) if stock markets in different countries are collectively efficient in the long run, then these asset prices are not cointegrated.

prices incorporate all available information. [90] Hence, Granger suggested that the prices of assets determined in efficient markets cannot be cointegrated.

However, one should be cautious when interpreting the notion that cointegration has implications for financial market efficiency. This proposition hinges critically upon the definition of market efficiency and it has recently been challenged by a number of authors (e.g. Dwyer and Wallace, 1992 and further discussion is provided at the end of the section.) Yet, based on Granger's traditional definition of market efficiency, this section reports the results of studies using unit root and cointegration tests.

From studies employing unit root tests, Taylor and Tonks (1989)[91], Ma (1990)[92], Andrade, Clare and Thomas (1991), Chan, Gup, and Pan (1992)[93], Arshanspalli and Doukas (1993)[94], and Blackman, Holden, Thomas (1994)[95], Lee and Jeon (1995) and others found that stock price series are almost invariably I(1), integrated of order one.

---

[90] In Fama (1991) review essay, he has redefined the three types of market efficiency; instead of weak, semi-strong and strong, he suggests tests for return predictability, event studies and tests for private information.

[91] The test statistics in this article are using (non-augmented) Dickey-Fuller statistics for five major stock markets, United Kingdom, West Germany, Netherlands, Japan, United States.

[92] The test statistics in this article are using both Dickey-Fuller (DF) and augmented Dickey-Fuller (SDF or ADF), (by Said and Dickey, 1984), statistics for five major stock markets, similar to Taylor and Tonks (1989), United Kingdom, West Germany, Netherlands, Japan, United States.

[93] The Philips-Perron unit root tests used in this article indicate that the null hypotheses of unit roots in both daily and weekly stock prices in major Asian markets, Japan, Hong Kong, South Korea, Singapore, Taiwan, and United States, are not rejected.

[94] Test for unit roots are performed using the Dickey-Fuller (DF) and the augmented Dickey-Fuller (ADF) tests in this article.

[95] To test that the series value is stationary the Phillips-Perron approach is used for 17 major exchanges over the period 1970:1-1989:2.

Earlier studies using the cointegration method, such as Taylor and Tonks (1989) and Ma (1990)[96], carried out tests on the integration of domestic and overseas stock markets as the impact of the abolition of exchange controls. Taylor and Tonks found that the abolition of UK exchange controls did stimulate the integration of the UK stock market with others. Yet two studies, Ma (1990) and Andrade, Clare and Thomas (1991), challenged the cointegration model in the Taylor and Tonks' study. Ma stated that the Taylor and Tonks' model did not allow hypothesis tests about the cointegrating vector since the standard errors were wrong and would at best reveal only a single cointegration vector. Therefore, Taylor and Tonks' model may have been underspecified since the market index was modeled by another market and not by the other four markets. Both the studies by Ma and by Andrade, Clare and Thomas suggested that in the long run there is no evidence of cointegration.

On the other hand, studies by Blackman, Holden, and Thomas (1994) [97] and Lee and Jeon (1995) using the Johansen maximum likelihood procedure, [98] support the view that there were more cointegrating vectors in the late 1980s than in the 1970s.

---

[96] Both studies use monthly data for five major stock market indices, United Kingdom, West Germany, Netherlands, Japan, and the United States, for the period January 1973 to June 1986. Tests were carried out with respect to two subperiods: October 1979 to June 1986, and April 1973 to September 1979.

[97] Monthly share price data for 17 major exchanges over the period 1970:1-1989:2 is used in this article. In addition, two subperiods: 1970:1-1979:12 and 1984:1-1989:2, are tested, corresponding to before and after the development of global markets.

[98] See, for example, Johansen (1988, 1989), Johansen and Juselius (1990), and Hall (1989). See also the discussion in section 3.3.3.

The alleged inconsistency between cointegration and efficient markets has been challenged in the last few years. It has been argued that the definition of efficient markets as markets in which changes in asset prices are unpredictable does not contain much economic substance. Market efficiency can be defined more usefully as a lack of arbitrage opportunities. This is the concept adopted by Dwyer and Wallace (1992), who claim that predictability of future stock prices does not imply inefficient markets. According to them, there are no risk-free returns above opportunity cost that are available to agents given transaction costs and agents' information. Hence, they suggested that the alleged inconsistency of cointegration and efficient markets relies on the conjunction of two assertions: changes in asset prices cannot be predicted in efficient markets; and a deviation of prices from a cointegrating relationship implies predictable future changes. They demonstrate that market efficiency does not preclude cointegration. Since the publication of Dwyer and Wallace's (1992) work, studies on the tests for cointegration have been conducted.[99] [100]A commonly held view in these studies is that cointegration tests can still be usefully employed to investigate the predictability of asset prices. Hence, the absence of cointegration simply rules out the existence of a long-run equilibrium tending relationship, but does not invalidate any short-run relationships that may arise due to profit-seeking opportunities.

---

[99] For example, see Caporale and Pittis (1998), Crowder (1996), Masih and Masih (1995 and 1996), Richard (1996) and Yuhn (1996), to mention a selection

[100] In this article, Caporale and Pitts (1998) re-examined the relationship between cointegration and unpredictability of asset prices. They argued that even if it can be demonstrated that cointegration has nothing to do with market efficiency, the former is still a useful tool of analysis to determine whether or not asset prices are predictable.

2.2.2 Interdependencies of Stock Markets

The above section has addressed the question of market integration by examining the literature on the "co-movement" of national stock price indices. However, the use of correlation coefficients in previous empirical studies of the co-movement of stock market price indices is questionable.[101] One reason is that the correlation coefficients do not provide information on causal relationships between variables in the model. Thus, strong positive correlations in the rates of stock price returns do not provide strong evidence to show whether stock markets are integrated across countries or rather that stock markets are segmented and responding to common international shocks.

Therefore, the primary goal of this section is to examine the literature which discusses and tests for interdependencies between the time-series of stock market price indices, in order to support or reject the proposition that the world's stock markets are becoming more integrated. The main difference and the basic aim of the study of interdependencies, rather than just "co-movement", is that the study of interdependencies moves forward the analysis to examine the structures of stock price developments and the degree to which a change in one country's stock price index exerts an influence on other countries' stock price indices.

The relationships of "interdependency" among world stock price indices have been studied extensively in a variety of contexts and using different methodologies. Most

[101] See, for example, Khoury, Dodin, and Takada (1987); and Kohlhagen (1983). In Khoury, Dodin, and Takada's study, they examined the dependence between the financial markets of the major developed countries. Their results suggest that the presence of correlation, no matter what the size and the direction of the lag, is neither a necessary nor a sufficient condition for market integration.

of the existing literature in this area is based on daily observations over a large number of national stock indices. They are concerned with the following two issues: (1) how much of the movement in one stock market can be explained by innovations in other markets? and (2) are there any markets whose movements are causally prior to those of other markets?

To answer these questions, one method would be to employ a dynamic simulation model was used as by Schollhammer and Sand (1985 and 1987) who adopted an autogressive integrated moving average (ARIMA) model[102] or by Eun and Shim (1989) who used a vector autoregression (VAR) model.[103]

(I) ARIMA Model

Several studies, such as Cheung and Mak (1992),[104] Schollhammer and Sand (1985)[105] and (1987)[106], and Khoury, Dodin, and Takada (1987)[107] have adopted an

[102] The Autoregressive integrated moving average (ARIMA) model was stimulated by Box and Jenkins. ARIMA time-series analysis is a univariate time-series analysis which involved a three-step modeling procedures: (1) the identification of the order of the model, (2) estimating the parameters of the model, and (3) a diagnostic checking against misspecification and search for the direction of improvements. For further detail, please see Box and Jenkins (1970) and Nelson (1973).

[103] The vector autoregression (VAR) model is an effective means of characterizing the dynamic interactions among economic variables by reducing dependence on the potentially inappropriate theoretical restrictions of structural models. Hence, analysis of the pattern of innovations and responses in different markets can be precisely performed by the impulse response function (IRF) analysis and variance decomposition (VDC) available in the VAR model. For further detail on VAR technique, please see Chapter 4 or Granger (1969).

[104] This study is derived from the weekly return series of the Asian-Pacific emerging markets (Australia, Hong Kong, Korea, Japan, Malaysia, Philippines, Singapore, Taiwan, and Thailand) and the US market from the years 1977 through 1988.

[105] Schollhammer and Sand (1985), using daily data from January 1,1981 through June 30 1983, examine the stock market indices of the major European Common Market countries, Switzerland and the United States.

ARIMA model to examine the "interdependencies" among national stock markets. Their results suggest that various statistically significant degrees of interdependence exist among stock price movements for most of the investigated countries.[108]

The most important conclusion to be draw from the existing literature in this area is that the studies highlight the methodological problems associated with previous empirical studies. Khoury, Dodin, and Takada (1987), for example, indicated that the high or low positive correlations in the rates of return do not necessarily imply international equity market linkages. Scholhammer and Sand (1985) have shown that the levels of national stock price indices are non-stationary and the non-stationarity of international equity indices raises doubts about the consistency of the estimated standard errors. Hence, in order to make the equity index series stationary, the normal econometric practice has been to take the first differences of the series.

---

[106] In this study, very similar to their study on 1985, Schollhammer and Sand (1987) used daily closing prices of major industrial or composite indices on thirteen world stock exchanges cover the period from January 1, 1981 to June 30, 1983.

[107] The data used in Khoury, Dodin, and Takada (1987) are daily national averages on five world major stock markets, Canada, France, Germany, Japan, and the United States, starting on December 31. 1974, and ending on December 27, 1983.

[108] First, the result from Schollhammer and Sand (1985) showed significant interdependencies exist between four (Germany, the United Kingdom, the Netherlands and Switzerland) of six stock markets in their study. In their 1987's study, Schollhammer and Sand (1987) found that stock price developments of most of the investigated countries (Australia, Canada, Germany, Japan, Netherlands, Norway, Switzerland, Singapore, the United Kingdom and the United States) show various degrees of interdependencies. Then, the study by Khoury, Dodin, and Takada (1987) concluded that the U.S. market leads the other four markets (Canada, France, Germany, and Japan) and, hence, Japan, Germany, and France have a high contemporaneous correlation. Hence, Cheung and Mak (1992) found that the US market can be considered as a "global factor" and is found to lead most of the Asian-Pacific emerging markets with the exception of three relatively closed markets: Korea, Taiwan and Thailand.

(II) VAR Model

Another method to investigate the structure of interdependence among national stock markets is to apply a Vector Autoregressive (VAR) technique. The advantages of VAR analysis are that (1) the VAR model is not subject to any a priori restrictions on the structural relationships among the variables, and (2) an analysis of the pattern of innovations and responses in different markets can be precisely performed by the impulse response function (IRF) analysis and variance decomposition available in the VAR model. A number of studies have applied VAR models, including Eun and Shim (1989),[109] Jeon and Furstenberg (1990),[110] Mathur and Subrahmanyam (1992),[111] Chowdhury (1994) [112] and Lee and Jeon (1995). [113]

The results from both Eun and Shim (1989) and Lee and Jeon (1995) indicate that a substantial amount of interdependence exists among national stock markets, and the U.S. stock market is found to be the market with the greatest influence on other world markets. Moreover, the dynamic response pattern of impulse responses emerging

---

[109] Eun and Shim (1989) estimated a nine-market VAR system, including Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, the United Kingdom and the United States. The database used in this study consists of time series of daily stock market indices at closing time, and it covers the period December 31, 1979, through December 20, 1985.

[110] Jeon and Furstenberg (1990) applied the VAR approach to daily stock price indexes in four major world stock markets, including Germany, Japan, the United Kingdom, and the United States for the period January 1986 through November 1988.

[111] Mathur and Subrahmanyam (1992) examined the interdependencies among the four Nordic countries, Denmark, Finland, Norway and Sweden, and the United States by using the VAR technique for the period 1974 to 1985.

[112] The data used in Chowdhury's (1994) study consist of time series of daily stock market indices at closing time for five Asian NIEs (Hong Kong, Japan, Korea, Singapore, and Taiwan) and the United States, starting from January 2, 1986, and ending on December 30, 1990.

from the VAR analysis is consistent with the notion of informational efficient international stock markets.[114]

Another study, by Jeon and Furstenberg, obtains a very similar result to that of Eun and Shim. However, Jeon and Furstenberg go even further to examine the effect of the 1987 crash. Their results suggest a significant structural change in the world's major stock markets since the crash. The result from the impulse response function (IRF) in the VAR analysis not only finds that the degree of interdependencies of the major world stock markets has increased significantly since the crash, but it also suggests that the leadership of the U.S. stock market has been reduced.[115]

Unlike Eun and Shim (1989), and Jeon and Furstenberg (1990) who apply the VAR model to the world's major stock markets, Mathur and Subrahmanyam (1992), and Chowdhury (1994) apply the model to regional markets[116]. The results from these two sets of studies were not conclusive. In the Eun and Shim, and Jeon and Furstenberg articles, an increasing integration among the world's major stock markets was shown.

---

[113] The weekly stock price series is used in Lee and Jeon (1995) for Japan, Germany, the UK and the US for the period from January 1975 to December 1990.

[114] In this study Eun and Shim analyzed the dynamic responses of each market to innovations in a particular market, and they found that most of the responses to a shock are completed within two days.

[115] In this study Jeon and Furstenberg reported that the size of the innovation transmission increased more than threefold after the crash. The evidence also suggested that the influence of the Japanese stock market on the US market has become stronger since the crash, while the influence of the US market on the Japanese market has been reduced.

[116] The regional markets are defined here not only according to geographical definition but also as the markets that have high economic interdependencies among themselves. According to Mathur and Subrahmanyam, the Nordic countries, including Denmark, Finland, Norway, and Sweden, share high economic interdependencies, and therefore, they may have high interdependencies among their stock markets. The same idea applies to Chowdhury, when he analyzed the relationship among four newly industrialized economies in Asia - Hong Kong, Korea, Singapore, and Taiwan.

Nevertheless, both Mathur and Subrahmanyam, and Chowdhury provided evidence that each of the regional markets (respectively, the Nordic countries and Asian-NIEs) are less than fully integrated within each region.

In Mathur and Subrahmanyam's article, they indicated the low level of co-variance with the U.S. market. Their results show that the U.S. market affected only the Danish market, but not the Norwegian, Finnish, or Swedish ones. The result from Chowdhury, importantly, indicated that the degree of the restrictions on foreign investment may significantly influence the degree of integration. Chowdhury showed that a significant link exists between these Asian NIE stock markets[117] that have no (or low) restrictions on foreign investment while the markets[118] with severe restrictions are not responsive to innovations in foreign markets.

The existing studies using the VAR technique provide evidence of increasing "integration" among the world's major stock markets. They suggested that the potential benefits of international diversification are declining because of growing interdependencies among the major stock markets. However, since there appears to be less than full intra-regional "integration," diversification benefits may exist within the regional markets.

---

[117] Such as Hong Kong, Singapore, Japan, and the United States.

[118] Such as Korea and Taiwan.

2.3 The Impact of Domestic Macroeconomic Fundamentals on Domestic Stock Market

An important empirical topic in the recent research on finance has been the economic role of stock market prices. Recent work has considered the notion that stock prices reflect fundamental macroeconomic variables. Therefore, stock price indices can be considered as one of the leading indicators of economic activity in business cycle analysis.

Yet, as mention earlier (sec. 2.2.1), the hypothesis of market efficiency has been one of the most controversial issues in modern financial economics over the past three decades or so.[119] Studies on the linkage between stock prices and macroeconomic activity are also controversial. For instance, the majority of early studies, such as Fama (1970) Gardiyvekus (1978) Castanias (1979) and Huang and Kracaw (1984), linked the stock market to real economic activities in terms of productivity, GNP and unemployment, among other variables. Their results confirmed that there is a strong relationship between the stock market and economic activity.

On the other hand, studies by Shiller (1981), Brainard, Shoven and Weiss (1980) and Summers (1982), found that the stock market does not always move with fundamentals in a manner consistent with the efficient markets hypothesis. The results from Summers (1982) and Brainard et al. (1980) argue that the low level of the stock

[119] The earlier overall conclusion of the efficient markets hypothesis seemed to be that the weak-form hypothesis was true, the semi-strong form was mainly true and the strong-form probably was not true. However, Fama (1991) again reviewed the literature and he replaced the three categories of EMH with (1) tests of return predictability; (2) event studies; and (3) tests of private information. Hence, the overall conclusion is that the market is much less efficient than academic economists previously thought.

prices could not be rationally related to economic realities. The study by Shiller (1981) demonstrated that the volatility of share prices is greater than it would be if the prices reflected future dividend payments in the way suggested by EMH and the present value model.

Thus, different studies have focused on different aspects of the relationship between stock returns and fundamentals. Recent evidence suggests that there exist more than just a single factor (market risk) which determines a stock's returns. The single factor capital asset pricing model[120] is clearly inadequate.

This section, therefore, starts with a brief discussion of the general aspects of the multi-factor model. It then investigates and presents arguments on the groups of studies: (1) studies which have focused on stock returns and the Arbitrage Pricing Theory (APT) model;[121] (2) studies which use multi-factor models [122] and finally; and (3) studies which examine the relationship between stock returns and macroeconomic variables using Granger Causality tests are also discussed.

---

[120] For example, the capital asset pricing model (CAPM), which states that the return on an asset is linked to a single factor, the market.

[121] Such as Chen, Roll and Ross (1986)

[122] Such as Pearce and Roley (1985)

2.3.1 Multi-factor Model

In recent years numerous theoretical models have been developed which attempt to establish a link between stock prices and macroeconomic variables. Most of these models contain an efficient markets assumption that involves some form of the basic formula:

$$P_t = E_t F'_t \qquad [2.3.1-1]$$

Where P_t represents the price of the stock at time t, while E_t denotes the conditional expectation operator given information available at time t and F'_t is a vector of fundamentals. Used in conjunction with the efficient market hypothesis, the original capital asset pricing model, CAPM, is a single-factor model, only with one element of F'_t.[123] Contrarily, the multi-factor CAPM has three components. They are: (i) the variables of risk that affect most of the stock prices; (ii) variables that reflect the risk exposures to these common sources of risk; and (iii) return components that are largely specific to a small subset of the stock prices.[124] Because of this decomposition, elements of the multi-factor CAPM have often been used as a framework for organizing facts about the structure of expected returns.

Which factors capture the data best? What are the relations among the factors which different researchers claim to have found? These are difficult questions and thus the main difficulty in building a multi-factor CAPM is to identify its factor variables.

[123] For a theoretical discussion of the factor formulations, see Fama (1976).

One approach is to deduce some factors from economic and financial theory and evaluate the diagnostic statistics of an econometric model that includes them. This approach is preferable to a data mining approach and can account for the anomalies that cannot be explained by the single factor capital asset pricing model. One example of this approach is the dividend discount model developed by Chen, Roll and Ross (1986).

The expected discounted dividends model is:

$$p = E(c) / k \qquad [2.3.1-2]$$

where

p: stock prices

c: dividend stream

k: discount factor

This model implies that the factors that influence returns are those which change the discount factor, k, and expected cash flows, E(c).

Previous studies by Fama (1981), Fama and French (1977, 1989), Geske and Roll (1983), Keim and Stambaugh (1986) and Campbell and Shiller (1988) also examined these sources of return variation. The results confirm that: (1) variation can be traced to forecasts of variables that are important determinants of cash flows (such as GNP, industrial production and investment); (2) shocks to expected returns and discount rates that generate opposite shocks to prices, therefore, "discount-rate effect" do exist. Furthermore, to test the factors in a multi-factor CAPM leads us to the next discussion on model application.

2.3.2 Arbitrage Pricing Theory (APT) Model

The empirical study by Chen, Roll and Ross (1986)[125] estimated an arbitrage pricing theory (APT) version of the multi-factor model. It tests whether innovations in macroeconomic variables are risks that are rewarded in the stock market. Hence, the factors are constructed to capture the common movements in stock market returns. The authors specified a number of factors that could affect the discount rate or expected cash flows. The relevant variables they proposed are: the spread between long- and short-term interest rates, expected and unexpected inflation, industrial production, and the spread between high- and low- grade bonds.[126] After testing these variables, they constructed a multi-factor model:

$$R_t = a + b_{MP}\,MP_t + b_{DEI}\,DEI_t + b_{UI}\,UI_t + b_{UPR}\,UPR_t + b_{UTS}\,UTS_t + e_t \qquad [2.3.2-1]$$

where
- R_t: stock return
- MP_t: industrial production, monthly growth
- DEI_t: change in expected inflation
- UI_t: unexpected inflation
- UPR_t: risk premium
- UTS_t: term structures
- e_t: error term

[125] In this article, Chen, Roll and Ross studied US stock prices behavior over the period of January 1953 to November 1983.

[126] Note that APT assumes that investors are rational risk averters who diversify. Therefore, only systematic risk factors are used in APT, because they are the undiversifiable risks that cannot be eliminated.

The result from showed that covariances of asset returns with shocks to the variables are likely to help explain differences in expected returns in the multi-factor model. The cross-section tests on stock returns supported this hypothesis.

Hence, results showed that several of the economic variables were found to be significant in explaining expected stock returns. The influence of industrial production, changes in the risk premium, and twists in the yield curve, were most significant. Thus, the two inflation variables (measure of unanticipated inflation and changes in expected inflation) showed less significant influence.

In addition, the study also examined the influence on pricing of exposure to innovations in real per capital consumption and the impact of an index of oil price changes on asset pricing. Both results were quite disappointing: the consumption variable was not significant and, also, there were no overall effects of oil price change.

However, one important conclusion from the study by Chen, Roll, and Ross is that stock returns are exposed to systematic economic news which are priced in accordance with their exposures. Hence, the news can be measured as innovations in state variables whose identification can be accomplished through simple and intuitive financial theory.

2.3.3 Other Results

(I) Pearce and Roley (1985)

A study by Pearce and Roley (1985)[127] used survey data in a multi-factor capital asset pricing model to investigate the market participants' expectations of certain economic announcements. Hence, the factors are constructed to capture the possible links between stock prices and new information.

The specific factors of the model are: money stock, inflation, output, and the Federal Reserve's discount rate. After testing these factors, a multi-factor capital asset pricing model is constructed. The model is as follows:

$$\Delta SP_t = a + b_1 M_t + b_2 CPI_t + b_3 PPI_t + b_4 IP_t + b_5 RU_t + b_6 RD_t + b_7 RS_t + e_t \qquad [2.3.3-1]$$

where

ΔSP_t :	change in stock prices, in percent
M_t :	announced weekly change in narrowly defined money stock, in billions of dollars
CPI_t :	announced percentage change in the consumer price index
PPI_t :	announced percentage change in the producer price index
IP_t :	announced percentage change in the industrial production index
RU_t :	announced percentage of the labour forces unemployed
RD_t :	announced change in the discount rate
RS_t :	announced change in the surcharge rate
e_t :	error term

[127] This study contains US data for the period of September 29, 1977 to October 15, 1982.

The empirical results from this study showed that new information which is related directly to monetary policy has a significantly negative effect on stock prices. But, on the other hand, there is limited evidence of stock price responses to the effect of inflation and there is no response of stock prices to the effect of real activity.

An interesting result in the Pearce and Roley study was that lag effects existed in the study since some evidence showed that the response of stock prices to new information may persist beyond the announcement day. Furthermore, the results supported the prediction of the efficient market hypothesis that anticipated components of economic announcements do not significantly affect daily stock price movements.

(II) Fama (1990) and Schwert (1990)

Two similar studies by Fama (1990) and Schwert (1990)[128] analyzed the relationship between real stock returns and real activity. In these studies, Fama and Schwert investigated the efficiency or rationality of stock prices. The variables used to proxy for the total return variation are: dividend yields on stock, default spreads on corporate bonds and the term spreads on bonds.

The model is as follow:

$$R_{(t,\,t+T)} = a + b_1 X_t + b_2 TERM_t + b_3 DSH_{(t,\,t+T)} + b_4 Y_{(t,\,t+T)} + e_{(t,\,t+T)} \qquad [2.3.3-2]$$

where

$R_{(t,\,t+T)}$:	the continously compounded real stock return from t to t+T. (as T=1 monthly; T=3 quarterly; T=12 annually)
X_t:	either the dividend yield, D_t / V_t or the default spread, DEF_t
$TERM_t$:	term spread
$DSH_{(t,\,t+T)}$:	default spread shock
$Y_{(t,\,t+T)}$:	either term spread shock, $TSH_{(t,\,t+T)}$, or the production growth rates, $P_{(t+k,\,t+k+3)}$, which is the growth rate of seasonally adjusted production for the quarter from month t+k to month t+k+3

The evidence from Fama's study showed that the term spread is positively correlated with quarterly growth rates of production, but, on the other hand, the dividend yield, the default spread, and a shock to the default spread are negatively correlated with the production growth rate.

In this study, Fama combined three sources of variation in stock returns to judge the efficiency of stock prices, and found that the combined explanatory power of the variables is less than the sum of their separate explanatory powers. Hence, the model in Fama's study gives an answer to the question of whether real activity explains more return variation for longer return horizons. The evidence is that the proportion of the

[128] Schwert (1990) replicates Fama's (1990) article but using an additional 65 years of data. The time period covered in Fama (1990) is from 1953 to 1987, and in Schwert (1990) is from 1889 to 1988.

variation in returns due to information about production is captured better when longer-horizon returns are regressed on future production growth rates.

Stimulated by Fama's findings, Schwert (1990) used different data, an additional 65 years of data and a new index of industrial production to investigate the stability of the relations estimated by Fama. The result from Schwert's study confirmsed Fama's findings. The evidence showed that by using a much longer period, future production growth rates explain a large fraction of the variation in stock returns.

Schwert also compared the new Miron-Romer index of industrial production in his study with the Babson index in Fama's study, and found that the new Miron-Romer measure of industrial production is less closely related to stock price movements than the older Babson measures.

2.3.4 Granger Causality Tests

Other studies on the relationship between stock returns and macroeconomic fundamentals have used the Granger Causality test. The empirical Granger test procedure involves estimating the following regressions:

$$Y_t = a + \sum_{i=1}^{m} b_i Y_{(t-i)} + \sum_{i=1}^{n} c_i X_{(t-i)} + \mu_t \qquad [2.3.4-1]$$

$$X_t = a' + \sum_{i=1}^{m} b'_i X_{(t-i)} + \sum_{i=1}^{n} c'_i Y_{(t-i)} + \mu'_t \qquad [2.3.4-2]$$

where

a and a': constant

μ_t and μ'_t: random disturbances

Y_t: stock return series

X_t: macroeconomic variable series

Using the residuals from both regressions, the null hypothesis that all coefficients are zero, $b_1 = \ldots b_i = 0$; and $c_1 = \ldots c_i = 0$, can be tested. The null hypothesis can be interpreted as the hypothesis that no Granger-causal relationship exists. However, it is important to note that the test for Granger-causality is more a temporal ordering and a

predictive ability rather than 'causality' as that word is commonly understood. [129] Yet another criticism is that the Granger-causality test is based on linear forecasting models. If the actual economic model is nonlinear, Granger-causality tests will be based on false forecasts and thus provide ambiguous results.

Two studies, by Huang and Kracaw (1984) and Fung and Lie (1990), apply the Granger causality test to investigate the "causal" relationship between stock returns and macroeconomic variables. In the Huang and Kracaw (1984)[130] study, two macroeconomic variables, GNP and unemployment, were examined. Their result indicated that measures of real activity, changes in the log of real GNP and unemployment, are Granger-caused by the variation of stock market returns.

On the other hand, Fung and Lie (1990)[131] applied the Granger Causality test to Taiwanese data to examine the economic role of the stock market in response to changes in economic variables, including GNP, money supply, velocity and inflation. They found that the volatility of the Taiwan stock index does not have any relationship with fundamental economic variables. Therefore, it implies that the information captured in the stock market does not reflect changes in the macroeconomic variables. As these two studies examined very different markets - one a developed market (the US) and the other a developing market (Taiwan), it is not surprising that different results were found.

---

[129] Therefore, it has been suggested that "causality" be replaced by "precedence"

[130] This study uses quarterly data spanning the period 1962 Q2 to 1978 Q4 for the US market.

[131] This study uses quarterly data covering 1977 to 1987 in Taiwan.

2.4 Studies on Asia-Pacific stock markets

The majority of early studies on Asia-Pacific stock markets focused only on the Japanese stock market. [132] These studies examined such issues as the daily and intra-day patterns in index return; [133] the size and seasonal anomalies; [134] the relationship between expectational data and actual stock performance; [135] and finally, the difference between the US and Japanese P/E multiples. [136]

It was until the late 1980s that the other Asia-Pacific stock markets, the so called 'emerging markets,' including Hong Kong, Korea, Malaysia, Singapore, Taiwan and Thailand, had grown in importance. However, during its period of fast growth, investment from outside the Asia-Pacific region, especially from other region's developed markets, increased. Apart from sharing the economic growth of the region, the reason for this rising interest in investing in the Asia-Pacific markets was to reduce risk through global diversification.

As evidence, a growing number of studies on Asia-Pacific stock markets have addressed the issues of market integration and the effect of fundamentals on stock markets. This new set of studies broadens the range of research topics, and is an

---

[132] Due to its rapid growth and increasing significance in the international financial arena, studying a market as important as the Japanese stock market is of interest in its own right.

[133] e.g. Jaffe and Westerfiekd (1985), and Kato, Ziemba, and Schwartz (1990)

[134] e.g. Kato and Schallheim (1985)

[135] e.g. Elton and Gruber (1989)

[136] e.g. Bildersee, Chen and Lee (1990), and French and Poterba (1990)

encouraging development in the research on Asia-Pacific stock markets. This section discusses this literature.

A considerable amount of work has been done to investigate the relationship (or linkage) among the national stock markets within the region. The results from existing studies indicate that Asian-Pacific stock markets are less than fully integrated. Studies by Cheung and Ho (1991), Cheung and Mak (1992), Chan, Gup, and Pan (1992), Park and Fatemi (1993) and Allen and Macdonald (1995) all show that there is potential benefit for international diversification.

The study by Cheung and Ho (1991)[137] examined the benefit (if any) of diversification from developed markets to Asia-Pacific emerging markets (AEMs), and their evidence shows that the correlation between the developed market group and the AEM group is smaller than among the developed markets. Therefore, the benefit of diversification does exist for investors in the developed countries to invest in the Asia-Pacific emerging markets.

Studies by Chan, Gup and Pan (1992) and Allen and Macdonal (1995) confirm this finding. Unit root and cointegration tests were used in both studies. Chan, Gup and Pan (1992)[138] examined the stock prices in major Asian markets and the US market.

---

[137] In this study seven Asia-Pacific emerging markets, Hong Kong, Korea, Malaysia, the Philippines, Singapore, Taiwan, and Thailand, and four developed markets, Australia, Japan, the UK, and the US, were examined with particular emphasis on the stability of the relations between the developed markets and the AEMs. The sample period covers January, 1977 to June, 1988, excluding few weeks after the October 1987 crash. Weekly return series were calculated for the study.

[138] The unit root and cointegration tests were used in this study to examine the relationship among the stock markets in Hong Kong, Japan, Korea, Singapore, Taiwan, and the US. Both daily and weekly indices data, cover February 1, 1983 to May 18, 1987, were used.

They found that all stock price series are I(1) series and no cointegration vector exists in their study.

The Allen and Macdonal (1995) [139] study which was conducted from the viewpoint of an Australian investor, [140] suggested that for most pairwise portfolios there exist potential long-run portfolio diversification gains for the Australian investor in the sense that there was no evidence of cointegrating relationships.

Cheung and Mak (1992)[141] provided evidence that the US stock market leads most of the Asia-Pacific stock markets, except Korea, Taiwan and Thailand. They suggested that the difference in results with these three markets and the other Asia-Pacific markets is the difference in the countries' external capital controls. Furthermore, they argue that the effect of a global factor, such as the US market, seems to exist in this region and that the regional factor, such as the Japanese market, seems to have a less significant impact.

The finding in Cheung and Mak (1992) was confirmed by Park and Fatemi (1993) and Chowdhury (1994) when they ran a VAR model to investigate the interrelationship among the Asia-Pacific stock markets. Park and Fatemi (1993) showed that Asia-Pacific markets are not fully integrated, offering substantial potential for risk

---

[139] This study using monthly data for the period of 1970-1992, reported the results of a study of 16 countries.

[140] This study used the monthly data taken from the accumulation indices in the 15 external markets which are converted into Australian Dollar terms.

[141] Using weekly return series from 1977 to 1988, the causal relationship between the Asia-Pacific emerging markets and the two developed markets is examined. The countries include: Australia, Hong Kong, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, and the US in the ARIMA model of this study.

reduction. In his study, Chowdhury [142] indicated that the US stock market influenced, but is not influenced by the Asian markets. His result also suggests that the markets, such as Korea and Taiwan, with severe capital controls are not responsive to innovations in foreign markets.

In addition, one important point Chowdhury has found is that markets have become more integrated due to financial deregulation in recent years. Indeed, two other studies on Asia-Pacific stock markets which included more recent data sets, Corhay, Radm and Urbain (1995) [143] and Sewell, Stansell, Lee and Below (1996) [144] provided evidence of varying levels of market integration.

One question that may arise from the above literature is if Korea's and Taiwan's stock markets are found to be independent from others, does this mean that these markets are influenced by their own domestic factors? Cheong (1992)[145] used the multi-factor APT model to examine the relationship between stock returns and macroeconomic factors in the Korean stock market. He found that stock returns are more affected by

---

[142] The daily stock return data series used in this study consist of four newly industrialized economies (NIEs) in Asia - Hong Kong, Korea, Singapore, and Taiwan, and two developed markets - Japan and the US. The sample period covered from January 2, 1986 to December 30, 1990, including the stock market crash of October 1987.

[143] This study investigated the long run relationship among five major Pacific-Basin stock markets, Australia, Hong Kong, Japan, Singapore and New Zealand, over a sample period of February 1972 - February 1991.

[144] In this study, weekly changes for the period 1980 to 1994 in five Asia-Pacific stock indices (Korea, Taiwan, Japan, Singapore and Hong Kong), the US and the World Index were examined.

[145] The monthly stock return data series is used in this study during the period from January 1980 through December 1989. The macroeconomic variables are chosen as factors in the APT model, they are: risk premium, export price index, yields of corporate bonds, indies of labor cost per unit of output, producers inventory indexes, and money supply in the government sector. Note that money supply is excluded when he run a six factors APT model.

macroeconomic factors in the Korean market than in the US market. He also suggests the stocks become more sensitive to macroeconomic factors as time passes in the Korean stock market.

In contrast, Fung and Lie (1990)[146] examined the economic role of the Taiwan stock market in response to changes in economic activities, and their results indicate that the information captured in the stock market does not include changes in macroeconomic variables. Therefore, they argue that the Taiwan stock market is purely speculative.

Furthermore, as far as the relationship between fundamental variables and expected returns in the Japanese market is concerned, most of studies find evidence of the impact of various fundamental variables on Japanese stock market returns. For instance, Brown and Otsuki (1988) found evidence that from six to seven macrofactors are priced sources of risk in the Japanese equity market. Chan, Hamao and Lakonishok (1991) [147] found the book to market ratio and cash flow yield have the most significant positive impact on expected returns in the Japanese Market.

In addition, two studies, Campbell and Hamao (1992) and Kaneko and Lee (1995), investigated various economic state variables as systematic influences on US and Japanese stock market returns. Campbell and Hamao (1992) [148] reported that the dividend-price ratio and interest rate variables help to forecast excess returns in the

---

[146] This study applied the Granger Causality test to examine the relationship of Taiwan stock market and some economic variables. The economic variables include in this study are: GNP, money supply, velocity, and inflation. The quarterly data covering 1977 to 1987 is used in this study.

[147] Monthly data from January 1971 to December 1988 are used in this study.

[148] This study use monthly data for the period of 1971-1990.

Japanese market. They also argue that the US and Japanese markets are highly integrated though not perfectly.

On the other hand, by considering not only the economic factors but also international factors, Kaneko and Lee (1995) [149] found international factors such as changes in oil prices and, to a lesser degree, terms of trade and exchange rates are significant in Japanese stock market returns.

[149] An empirical VAR approach has been employed in this study for the sample period of 1975-1993.

Chapter 3 An Investigation of Short- and Long- Term Co-movements in Asia-Pacific Stock Markets

3.1 Introduction

A considerable amount of research suggests that the movements of returns (and prices) on different stock markets around the world have become closer in recent years.[150] This observation has led to a re-examination of the benefits of international diversification in terms of both short- and long- term inter-relationships among national stock markets and to a discussion of the impact of major international events, such as the 1987 stock market crash, as well as national events, such as financial liberalization, on the world's stock markets. The objective of this chapter is to investigate the short-term as well as the long-term changes in the co-movement patterns of Asia-Pacific stock markets before and after financial deregulation. Three empirical techniques -- correlation coefficients, unit root tests and cointegration tests -- are used in this chapter.

As far as short-term inter-relationships concerned, the correlation coefficients are used as a measure of the linear short-term association between the rate of stock returns in different markets. If correlation coefficients are not always unity, this means that there is room for successful risk diversification. Indeed, if the correlations between daily stock

[150] See, for example, Dwyer and Hafer (1988); Blackman, Holden and Thomas (1994); and Meric and Meric (1997).

returns are produced by international arbitrage, it may be expected, at least in the short-term, that financial deregulation would result in increased correlation.

Since stock price series are almost invariably found to be I(1),[151] tests for cointegration have frequently been used to address the notion about the nature of the long-run relationship between market indices of different countries. According to Granger (1986), the prices of assets determined in efficient markets cannot be cointegrated. Yet, this proposition hinges critically upon the definition of market efficiency.[152] Nevertheless, this study refers the term of market efficiency as traditional Granger's definition and uses it only for reference purpose. Thus, this chapter takes the view that the absence of cointegration simply rules out the existence of a long-term equilibrium tending relationship.

The remainder of the chapter is organized as follows. The next section contains a description of the data, while the following section compares correlation coefficients between eight national stock markets before and after key international and national events. Then, the methodology and empirical results of the unit root and cointegration tests are presented in the fourth section. The final section provides a summary of the findings and conclusions.

---

[151] Such as Taylor and Tonks (1989), Chan, Gup, and Pan (1992), Ma (1990), Arshanspalli and Doukas (1993), and Blackman, Holden and Thomas (1994).

[152] Note that tests for cointegration in previous studies have been also used as tests for market efficiency. This notion, however, has been challenged in recent years (Dywer and Wallace, 1992). See also section 2.2.3. for details.

3.2 Data

The data for this study consist of daily stockprice indices from January 03, 1977 to January 30, 1998 for eight Asia-Pacific countries, namely Australia, Hong Kong, Japan, Korea, Malaysia,[153] Singapore, Taiwan and Thailand. To examine the diversification of local stock market risk rather than currency risk, the indices in these markets are in local currencies.

The data are taken from Datastream and the Taiwan Stock Exchange.[154] Since the stock markets in Japan, Korea and Taiwan are open on Saturday,[155] any Saturday entries have been dropped. To ensure that each country has an entry on a given date, any data gaps caused by holidays and other non-working days have been adjusted. Note that the stock markets within the Asia-Pacific region operate in different time zones, but with only a small gap between them.[156] Nevertheless, the implications of using this overlapping data should be considered when interpreting the empirical results.

---

[153] Due to the availability of data in Datastream, Malaysia has the starting date of January 03, 1983.

[154] Datastream provided the daily stock market index, Taipei Weighted Stock Price Index, for Taiwan only from January 1, 1984. Therefore, data before 1984 was taken directly from the Taiwan Stock Exchange.

[155] See each stock market's "Factbook" in Japan, Korea, and Taiwan for details.

[156] Hours ahead of GMT time in each country: Thailand (GMT + 5); Hong Kong (GMT + 6); Singapore and Malaysia (GMT + 7); Korea and Taiwan (GMT + 8); and Australia and Japan (GMT + 9). The biggest gap is between Thailand and Australia which is less than 4 hours.

For many Asia-Pacific stock markets, it was only been in the late 1980s or early 1990s that the flow of investments into these markets became significant.[157] For this reason, it is important to analyze the implications of stock market data over different sample periods. Hence, the data set is divided into two sub-periods. The first period runs from January 03, 1977 to December 31, 1986 and corresponds to a period when most Asia-Pacific stock markets were less accessible to foreign investors. The second period covers the period from January 03, 1988 to January 30, 1998 and corresponds to a higher level of financial liberalization.

In addition, several studies have examined the co-movements among national stock markets and concluded that national stock markets moved closer in the period after the 1987 crash. The data set in this study also excludes the period from January 01, 1987 to December 31, 1987. The reason for excluding 1987 data is to avoid the disturbance of the stock market "crash" in 1987.[158]

---

[157] See, for example, section 1.3 in this thesis for a discussion of inflows into the region. However, the annual average net portfolio inflows in Asian-Pacific region were around US$ 0.6 billion in the 1970s, US$ 1.4 billion in the 1980s, but in the 1990s has been US$ 17.4 billion. For further information on capital flows, see also *World Financial Markets* by JP Morgan and *World Economic Outlook* data base by International Monetary Fund.

[158] The reason that the 1987 crash is given special consideration in this study rather than others, such as Mexico Crisis in 1994 and the Asian Crisis in 1997, is the scale of the crisis.

3.3 Correlations Test: Short-Term Inter-relationship

This section uses daily stock returns[159] to examine the correlation between eight Asia-Pacific stock markets. Correlation coefficients are used to measure the extent of the association between the stock returns. The basic aims here are: (1) to compare the relationships among the Asia-Pacific stock markets before and after financial deregulation; (2) to identify if any short-term co-movement exists in the region; and (3) to discuss whether there is any benefit for international diversification in the future.

The methodology of the correlation test is explained in section 3.3.1. Section 3.3.2 then tests and reports the empirical results of the correlation coefficients.

3.3.1 Methodology

Correlation coefficients are often used to identify which markets move more closely in the short-term. Correlation is a statistical attribute of a pair of markets which can be calculated by the following equation:

$$r_{xy} = \frac{[\ \Sigma xy - (\ \Sigma x \Sigma y\ ) / n\ ]}{[\Sigma x^2 - (\ (\Sigma x)^2 / n\ )(\Sigma y^2 - (\ (\Sigma y)^2 / n\ )]^{1/2}} \qquad [3.3.1\text{-}1]$$

$$= \text{covariance}(\ x, y\ )\ /\ (\ \text{var}(x)\ \bullet\ \text{var}(y)\ )^{1/2} \qquad [3.3.1\text{-}2]$$

[159] The daily stock return is calculated as the first difference of the logarithm of the market index in local currency.

Correlation coefficients may take any value between minus one and plus one. A value near zero means that daily percentage movements in two markets bear essentially no relationship to each other during the period. A positive (negative) value means that when one market rises at more than its trend rate, the other on average rises above (falls below) its trend rate. A positive (negative) value close to plus (minus) one means that when one market's rise equals one standard deviation above its trend, then the other market can on average be expected to rise (fall) at close to one standard deviation above (below) its trend as well. To test the significance of the correlation coefficient, a t-test is used under the null hypothesis of the correlation coefficient being zero against the alternative that it is not zero. The test statistic for the correlation coefficient which has a t distribution with T-2 degrees of freedom is calculated as:

$$t \text{ statistic} = [(T - 2)\, r^2 / (1 - r^2)] \qquad [3.3.1\text{-}3]$$

In addition, since the comparison between two sub-periods is discussed in this study, it is necessary to test the significance of equal correlation coefficients. The test statistic for equal correlation coefficients is a one-tailed test, under the null hypothesis that corresponding correlation coefficients are equal in the two sub-periods against the

alternative that the second period is greater than first period. [160] The test statistic for equal correlation coefficients which has a standard normal distribution with T-3 degrees of freedom, is calculated as:

$$t = \frac{1/2 \{ \ln[(1 + r_2) / (1 - r_2)] - \ln[(1 + r_1) / (1 - r_1)] \}}{\{ [1 / (T_2 - 3)] + [1 / (T_1 - 3)] \}} \qquad [3.3.1\text{-}4]$$

After calculating the correlation coefficients and significance levels, it may be concluded that at the 5% significance level, there should be some linear association between tested pairwise markets.

[160] For further details on both test statistics for correlation coefficients and equal correlation coefficients, see Dougherty (1992).

3.3.2 Empirical Results

Correlation coefficients between the daily stock returns in eight Asia-Pacific markets indicate that there was a significant difference between sub-periods 1 and 2 in terms of the degree of association in these markets. The results of correlation coefficients and the test statistics are reported in Table 3.3-1 for sub-period 1; and in Table 3.3-2 for sub-period 2. Table 3.3-3 reports the test of equal correlation coefficients.

A comparsion of Tables 3.3-1 and 3.3-2 show an overall improvement of both correlation coefficients and the significance for each pair from sub-period 1 to 2. In Table 3.3-1, most of the correlation coefficients in sub-period 1 are not significantly different from zero for 15 of the 28 market pairs examined, with the exception of the pair of Singapore and Malaysia which has a significant correlation coefficient of 0.368.

In contrast, Table 3.3-2 shows that the correlation coefficients in sub-period 2 are all positive and all significantly different from zero. Another notable fact in the second period is that the correlation coefficients between Singapore and Malaysia (0.675); Singapore and Hong Kong (0.507); and Malaysia and Hong Kong (0.452), all yield very high correlation coefficients significant at the 5 per cent level, while Korea pairwise with country yields lower correlation coefficients. This may be due to the difference in degree of financial liberalization among these countries, for the higher the degree of financial liberalization is, the higher the degree of openness of the market.

The above results are confirmed in Table 3.3-3 as a hypothesis for equal correlation coefficients is tested. Table 3.3-3 shows that the null hypothesis of correlation coefficients being the same for the two periods is rejected in 25 out of the 28 cases. Hence, the results from correlation tests indicate that the daily stock returns are more highly correlated in the period after financial deregulation.

In addition, because of economic interdependence, Singapore and Malaysia are usually considered analytically as a single unit or twin market. The result in this study provides further evidence regarding this relationship. The pair of Singapore and Malaysia has the highest correlation coefficients at the 5 per cent significance level in both sub-period 1 (0.386) and sub-period 2 (0.672). Although these correlations are the highest, they are much less than plus unity. Therefore, it is not valid to treat them as a single market (and it should also be noted that a test of the single market hypothesis assumes a test of the law of one price, which correlation coefficients alone cannot provide). Another interesting point here is that Singapore and Malaysia both also yield higher correlation coefficients (most are significant) with other markets. This result may be due to the fact that both markets have higher levels of financial liberalization.

In contrast, Korea, Taiwan, and Thailand yield lower correlation coefficients with less significant pairs in sub-period 1. There are sharp increases in correlation coefficients and significance levels in sub-period 2 for both Taiwan and Thailand, while Korea, with an improvement in the significance level, still yields the lowest correlation

coefficients in the region. This comparison may imply that the pace of financial deregulation is slower in Korea than the other two countries.

Overall, the results from the correlation coefficients may suggest some conclusions concerning short-term relations between Asian-Pacific stock markets. One is that short-term co-movements do exist after financial liberalization as the result shows an overall improvement on both correlation coefficients and their significance in the period following the deregulation. Hence, the correlation coefficients indicate that the short-term co-movements among Asia-Pacific stock markets may suggest that the benefits of any short-term diversification, or speculative activities, are limited within the region.

Another conclusion is that the correlation coefficients in this study suggest that not only the degree but the pace of financial liberalization may have an impact on the role and short-term relations between Asia-Pacific stock markets. For example, Singapore and Malaysia with higher levels of financial deregulation, are strongly related to each other and to others and they are the most open markets in the region. On the other hand, Taiwan and Thailand, with lower levels of financial deregulation but a faster rate of change toward deregulation, have correlation coefficients which increased quite sharply in significance in the second period. Unlike them, Korea, with a lower level and pace of financial deregulation, is very isolated and seems to play a less important role in the region.

Table 3.3-1 Correlation Coefficients, Sub-period 1: 03/ 01/ 1977 - 31/ 12/ 1986

	Hong Kong	Japan	Korea	Malaysia**	Singapore	Taiwan	Thailand
Australia	0.148 (7.6)	0.185 (9.6)	0.012 (0.6)*	0.065 (2.1)	0.081 (4.1)	0.005 (0.2)*	-0.007(0.3)*
Hong Kong		0.067 (3.4)	-0.012(0.5)*	0.089 (2.8)	0.147 (7.5)	-0.001(0.0)*	-0.021(1.0)*
Japan			0.047(2.4)	0.024 (0.7)*	0.069 (3.5)	-0.067(3.4)	0.033 (1.6)*
Korea				0.028 (0.9)*	0.022 (1.1)*	-0.028(1.4)*	0.026 (1.3)*
Malaysia**					0.368(12.7)	0.032 (1.0)*	-0.001(0.0)*
Singapore						0.004 (0.2)*	0.056 (2.8)
Taiwan							0.051 (2.6)

Note: Test statistics for correlation coefficients are in ( ), and the critical value (5%) is +/- 1.96.
* The null hypothesis of correlation coefficients equal to zero is accepted.
** Sample period for Malaysia: 03/ 01/ 1983 - 31/ 12/ 1986

Table 3.3-2 Correlation Coefficients, Sub-period 2: 03/ 01/ 1988 - 03/ 01/ 1998

	Hong Kong	Japan	Korea	Malaysia	Singapore	Taiwan	Thailand
Australia	0.394 (21.9)	0.312 (16.8)	0.105 (5.4)	0.332 (18.0)	0.389 (21.6)	0.183 (9.5)	0.154 (7.9)
Hong Kong		0.267 (14.2)	0.072 (3.7)	0.452 (25.9)	0.507 (30.1)	0.221 (11.6)	0.139 (7.1)
Japan			0.059 (3.0)	0.244 (12.8)	0.319 (17.2)	0.152 (7.8)	0.144 (7.4)
Korea				0.137 (7.0)	0.089 (4.5)	0.108 (5.5)	0.078 (4.0)
Malaysia					0.672 (46.5)	0.312 (16.8)	0.163 (8.4)
Singapore						0.313 (16.8)	0.179 (9.3)
Taiwan							0.148 (7.6)

Note: Test statistics for correlation coefficients are in ( ), and the critical value (5%) is +/- 1.96.

Table 3.3-3 Test Statistics for Hypothesis of Equal Correlation Coefficients; Critical Value (5%): 1.645

	Hong Kong	Japan	Korea	Malaysia**	Singapore	Taiwan	Thailand
Australia	9.674	4.905	3.378	7.639	12.568	4.887	5.869
Hong Kong		7.471	3.007	10.859	14.853	8.489	5.821
Japan			0.435*	6.139	9.456	7.969	4.051
Korea				2.998	2.432	4.935	-6.579*
Malaysia**					11.686	0.072*	4.761
Singapore						10.269	4.518
Taiwan							3.547

* The null hypothesis of correlation coefficients for both periods being equal is accepted.
** Note that the test statistics for Malaysia is involve different calculation since the sample period (T1) for Malaysia is different from others in period 1.

3.4 Unit Root and Cointegration Tests: Long-Term Inter-relationship

The basic aim of this section is to investigate whether there are any long-term statistical relationships between the prices on different national stock markets before and after financial deregulation and pre- and post- 1987 crash. This section use the logarithms of the daily stock market index to analyze each market both individually (unit root tests) and collectively (cointegration tests) to test for, in both pairwise and multivariate contexts, a long-term relationship.

The data is described in section 3.2. The methodology of unit root and cointegration tests is explained in section 3.4.1. Section 3.4.2 reports the empirical results of the tests.

3.4.1 Methodology

The approach for testing the long-term inter-relationship is first to establish whether individual stock market prices have a linear trend, such as I(1), or are stationary, I(0). Once the degree of integration is determined, then the cointegration of two variables, each I(1), can be tested. However, if of the two variables, one is I(0) and the other I(1), they cannot be cointegrated and in the long-term they must move apart. The details of these two steps (unit root and cointegration tests) is discussed in following sub-sections.

(I) Unit Root Tests

The unit root issue arises in the presence of non-stationary variables. The major problem associated with regression on non-stationary variables is 'spurious regression' resulting from non-stationarity of time series. [161] Therefore, to avoid the problem of spurious regression, it is necessary to test the order of integration of each variable in a model, to establish whether it is non-stationary and how many times the variable needs to be differenced to obtain in a stationary series.

There are several ways of testing for the existence of unit roots: the Dickey-Fuller (DF) approach (which tests the null hypothesis that a series does contain a unit root against the alternative of stationarity); the Sargan-Bhargava CRDW-test based on the usual Durbin-Watson statistic; and the Phillips-Perron Test. The Phillips-Perron test is a modification of the DF approach that makes less restrictive assumptions about the error process. However, the small-sample properties of DF tests are better in cases of non-normal errors and heteroskedasticity, but the Phillips-Perron test allows the disturbances to be weakly dependent and heterogeneously distributed. Hence, Phillips-Perron is to be preferred if the sample size is quite large.

[161] A spurious regression often has a high R^2 because the least-square estimates are not consistent. Also, the t-statistics in a spurious regression appear to be significant since the customary tests of statistical inference do not hold. However, The output of a spurious regression may "look good" but it has no economic meaning.

The emphasis in this study is on using the Phillips-Perron (PP) approach. Following Phillips and Perron (1988),[162] three regression models are used to test for the unit roots. They are:

Model 1: with constant and trend

$$Yt = \hat{u} + \beta(t - (T/2)) + \hat{a}\, Yt\text{-}1 + et \qquad Ho: \hat{a} = 1 \qquad [3.4.1\text{-}1]$$

Model 2: with constant but not trend

$$Yt = \ddot{u} + \ddot{a}\, Yt\text{-}1 + et \qquad Ho: \ddot{a} = 1 \qquad [3.4.1\text{-}2]$$

Model 3: without constant and trend

$$Yt = \mathring{a} Yt\text{-}1 + et \qquad Ho: \mathring{a} = 1 \qquad [3.4.1\text{-}3]$$

where

Yt:	any stock price series (in log)
$\hat{u}$ and $\ddot{u}$:	constant
T:	total number of observation
et:	error terms

The Phillips-Perron (PP) test statistics are based on the Phillips Z-Test. The Phillips Z-test involves transforming the test statistic to eliminate any autocorrelation in the model.[163] The Phillips-Perron test consists of calculating the DF statistic, a t-value, and then adjusting this statistic before consulting the critical values.[164]

---

[162] See Phillips and Perron (1988).

[163] The Phillips-Perron test suggests a non-parametric-based correction to DF tests for use whenever it is suspected that the errors are autocorrelated or heteroskedastic.

(II) Cointegration Tests

Cointegration analysis provides a way of testing whether there is a long-term statistical relationship between two (pairwise) or more (multivarate) variables. The basic concept is that if two variables each follow an upward trend then, in general, they will diverge in the long-term. The exception to this is when there is a functional relationship between the variables such that the residual from this relationship is stationary. In this case, the variables are said to be cointegrated. Hence, if non-stationary variables are cointegrated then regression analysis imparts meaningful information about long-run relationships, whereas if cointegration is not established then spurious correlation remains. For example, suppose:

$$Yt = b\,Xt \qquad [3.4.1\text{-}4]$$

and

$$Zt = a_1\,Yt + a_2\,Xt \qquad [3.4.1\text{-}5]$$

For Xt and Yt to be cointegrated it is required that the two series should be integrated to the same order, such as I(1), and that a linear combination of the two series, Zt, should exist which is integrated to a lower order than the individual series, such as I(0). It has been shown above that equilibrium or a long-term relationship between a set of time-series variables requires that there exist a stationary linear combination of the variables. How can one establish which linear combination of Xt and Yt is I(0)? In this

[164] The critical values for the PP statistics are precisely those given for the DF tests.

study, the Johansen Maximum Likelihood test[165] is chosen. There are three advantages of the Johansen maximum-likelihood (ML) approach are. (i) It gives consistent ML estimates of the whole cointegrating matrix, and produces a likelihood-ratio statistic for the maximum number of distinct equilibrium vectors in the matrix. Thus it is possible to identify the whole set of cointegrating relationships using this method. (ii) The LR test statistic in the maximun-likelihood estimator has an exact known distribution which is a function of just one parameter.[166] (iii) Given these distributional properties of the ML estimator, specification tests can be carried out on the cointegrating vectors[167].

In this study, if two or more stock market price indices, all I(1) series, are said to be cointegrated, it implies that: in the long-run there is an equilibrium relationship between them, and even though the price series themselves may be non-stationary they will nevertheless move closely together over time.

---

[165] For detail, see Johansen (1988), and Johansen and Juselius (1990). Good summaries and applications are available in Hall and Henry (1988), and Hall (1989), also see Muscateli (1990).

[166] Test statistics in the EG approach cannot be compared with critical values from known distributions, as the distribution is a function of the whole unknown data-generation process.

[167] This facility is not directly available in the EG two-step framework.

3.4.2 Empirical Results

This section uses the logarithms of the daily stock market indices to examine the long-term inter-relationships between eight Asia-Pacific stock markets before and after financial deregulation and pre- and post- 1987 crash. Before testing for cointegration, the order of integration of the national indices must be determined. Then, it is possible to proceed to the cointegration tests if the result of unit root satisfies the first condition of cointegration that two or more series should be integrated to the same order. The results are discussed below.

3.4.2.1 Unit Root Tests

The results of unit root tests for eight Asian-Pacific stock markets are reported in Table 3.4-1 for sub-period 1 and Table 3.4-2 for sub-period 2.

The results for both sub-periods show that the null hypothesis of a unit root cannot be rejected which indicates the presence of a unit root in the levels of all indices. There is no evidence to support the presence of a unit root in first differences of the stock price indices, hence, changes in stock prices are stationary. In other words, all stock price series are integrated of order one, I(1), in both sub-periods. Thus, the uniqueness of a unit root in the stock price level is confirmed.

Table 3.4-1 Phillips-Perron Tests of Unit Roots, Sub-period 1: 03/ 01/ 1977 - 31/ 12/ 1986

	Test Statistics									
	With Constant and Trend				With Constant but Not Trend			No Constant and Trend		
	Z(T(rho-1))	Z(t(rho-1))	Z(t(beta))	Z(PSI3)	Z(T(rho-1))	Z(t(rho-1))	Z(t(alpha)	Z(T(rho-1))	Z(t(rho-1))	Orders of Integration
Australia	-2.23	-0.66	1.48	0.97	0.35	0.27	-0.07	0.26	2.98	**I(1)**
Hong Kong	-3.31	-1.03	1.36	1.08	-1.42	-0.72	0.89	0.34	1.71	**I(1)**
Japan	-4.39	-1.31	1.59	2.16	1.35	1.35	-1.19	0.15	3.78	**I(1)**
Korea	-0.81	-0.24	1.41	1.07	1.29	0.46	-0.39	0.19	1.64	**I(1)**
Malaysia	-10.02	-2.78	-2.76	4.17	-1.68	-0.86	0.84	-0.03	-0.32	**I(1)**
Singapore	-1.94	-0.75	0.45	1.29	-2.32	-1.62	1.75	0.18	1.85	**I(1)**
Taiwan	-5.71	-1.52	1.64	1.62	-1.71	-0.78	0.85	0.15	1.55	**I(1)**
Thailand	-2.41	-0.91	-0.41	0.99	-3.87	-1.47	1.53	0.16	1.39	**I(1)**
Crit. (.05)*	-21.8	-3.41	(+/-3.11)	6.25	-14.1	-2.86	(+/-2.83)	-8.1	-1.95	

Note: Critical values are given in Fuller (1976) and Dickey and Fuller (1981)

Table 3.4-2 Phillips-Perron Tests of Unit Roots, Sub-period 2: 03/ 01/ 1988 - 30/ 01/ 1998

	Test Statistics									
	With Constant and Trend				With Constant but Not Trend			No Constant and Trend		
	Z(T(rho-1))	Z(t(rho-1))	Z(t(beta))	Z(PSI3)	Z(T(rho-1))	Z(t(rho-1))	Z(t(alpha)	Z(T(rho-1))	Z(t(rho-1))	Orders of Integration
Australia	-10.48	-2.17	2.23	2.79	-1.73	-0.79	0.84	0.09	1.58	**I(1)**
Hong Kong	-6.46	-1.18	1.06	1.56	-2.09	-1.43	1.55	0.17	1.37	**I(1)**
Japan	-9.29	-2.21	-2.28	3.18	-3.04	-1.11	1.08	-0.06	-0.57	**I(1)**
Korea	-8.29	-2.01	-1.31	3.03	-9.17	-2.22	2.22	0.01	0.03	**I(1)**
Malaysia	0.73	0.19	-1.08	3.31	-4.44	-2.35	2.41	0.11	0.85	**I(1)**
Singapore	-2.41	-0.56	-0.33	2.47	-5.54	-2.24	2.26	0.06	0.61	**I(1)**
Taiwan	-8.57	-2.21	-0.35	3.77	-10.55	-2.76	2.79	0.13	0.89	**I(1)**
Thailand	-1.51	-0.54	-2.05	4.37	-5.31	-2.16	2.18	0.05	0.33	**I(1)**
Crit. (.05)*	-21.8	-3.41	(+/-3.11)	6.25	-14.1	-2.86	(+/-2.83)	-8.1	-1.95	

Note: Critical values are given in Fuller (1976) and Dickey and Fuller (1981)

3.4.2.2 Cointegration Test

Since the results from the unit root tests indicate that all the stock price series in both sub-periods are I(1), it is possible that combinations of the series may be cointegrated. Therefore, the Johansen technique is used to investigate the cointegration of stock price series.[168] Table 3.4-3 contains the results from the tests of cointegration. The findings, in general, are as follows:

First, there are no significant pairwise co-movements between the Asian-Pacific stock markets in the first period, with the only exception of the pair being Singapore and Malaysia (as in cointegrating equation 1). This result, however, is consistent with the result found in the previous test of correlation coefficients for sub-period 1 in Table 3.3-1.

Second, for the multivariate cointegration tests (for vectors of more than two markets), a total of 47 cointegrating vectors are found in the first period. This result seems to be in line with several studies, such as Jaffe and Westerfield (1985), Scholhammer and Sand (1985), and Eun and Sim (1989), which report a substantial co-movement among national stock markets for the pre-October 1987 period.

Third, this study finds that the omission from any sub-group of Malaysia and Singapore would be highly likely to result in no cointegrating vectors.

---

[168] In order to find all possible cointegrating vectors, a total of 464 equations were estimated in both sub-periods; only 48 cointegrating vectors were found. Nevertheless, it is important to realize that the

Fourth, this study also finds that sub-groups omitting Australia, Hong Kong and Japan, or any combination of two or three of these markets, would have a high probability of rejecting the null hypothesis of no cointegrating vectors.

Fifth, no evidence of pairwise or multivariate cointegration is found for the second sub-period. The absence of cointegration in the second sub-period rules out the existence of a long-term equilibrium tending relationship among Asia-Pacific stock markets.

To test whether any stock market is particularly significant, and hence, whether any sub-regional bloc exists, the subsets of the group are estimated. Indeed, a southern bloc, which includes Australia, Hong Kong, Malaysia, Singapore and Thailand, is found for the first period (as in the cointegrating equations 3, 4, 5, and 6), but not a Northern bloc, which including Japan, Korea and Taiwan.

In sum, the results from cointegration tests indicate that co-movements exist only in the first period. A southern bloc can also be identified in the first period. Thus, there is no evidence of the existence of a long-term equilibrium tending relationship among Asia-Pacific stock markets in the second sub-period Hence, the diversification within the region is effective for the second period, but not for the first period.

Johansen method only provides information on the uniqueness of the cointegrating space. Hence, identifying each individual cointegrating vector should be based on the economic implication.

Table 3.4-3 Johansen Cointegration Test

	Country								Likelihood	5% Critical	1% Critical
	Australia	**Hong Kong**	**Japan**	**Korea**	**Malaysia**	**Singapore**	**Taiwan**	**Thailand**	Ratio*	Value	Value
	Pairwise Cointegrating Vectors								Sub-period 1		
1					X	X			30.76818	25.32	30.45
	Multivarate Cointegrating Vectors								Sub-period 1		
	All Markets										
2	X	X	X	X	X	X	X	X	189.7996	182.82	196.08
	Southern Bloc										
3	X	X			X	X		X	91.58838	87.31	96.58
4		X			X	X		X	71.99378	62.99	70.05
5	X				X	X		X	71.60456	62.99	70.05
6					X	X		X	54.58877	42.44	48.45
	Others										
7		X	X	X	X	X	X	X	163.9059**	146.76	158.49
8	X		X	X	X	X	X	X	152.9989	146.76	158.49
9	X	X		X	X	X	X	X	161.4402**	146.76	158.49
10	X	X	X		X	X	X	X	151.0851	146.76	158.49
11	X	X	X	X	X	X		X	149.0343	146.76	158.49
12		X		X	X	X	X	X	136.336**	114.9	124.75
13		X	X		X	X	X	X	126.4983	114.9	124.75
14		X	X	X	X	X		X	126.2184	114.9	124.75
15		X	X	X	X	X	X		117.9674	114.9	124.75
16	X			X	X	X	X	X	130.3917**	114.9	124.75
17	X		X		X	X	X	X	118.757	114.9	124.75
18	X		X	X	X		X	X	117.8281	114.9	124.75
19	X		X	X	X	X		X	122.1345	114.9	124.75
20	X	X			X	X	X	X	118.6867	114.9	124.75
21	X	X		X	X		X	X	116.1543	114.9	124.75
22	X	X		X	X	X		X	130.6956	114.9	124.75
23				X	X	X	X	X	107.0591**	87.31	96.58
24			X		X	X	X	X	95.61811	87.31	96.58

Cont...

	Country								Likelihood	5% Critical	1% Critical
	Australia	**Hong Kong**	**Japan**	**Korea**	**Malaysia**	**Singapore**	**Taiwan**	**Thailand**	Ratio*	Value	Value
	Multivarate Cointegrating Vectors								Sub-period 1		
	Others										
25			X	X	X	X		X	100.8056**	87.31	96.58
26			X	X	X	X	X		92.86245	87.31	96.58
27		X			X	X	X	X	95.4632	87.31	96.58
28		X		X	X	X		X	108.2677**	87.31	96.58
29		X		X	X	X	X		95.98599	87.31	96.58
30		X	X		X	X		X	92.62415	87.31	96.58
31	X				X	X	X	X	93.90475	87.31	96.58
32	X			X	X		X	X	93.21237	87.31	96.58
33	X			X	X	X		X	106.4895**	87.31	96.58
34	X		X		X	X		X	89.7707	87.31	96.58
35					X	X	X	X	73.24294	62.99	70.05
36				X	X		X	X	72.27829	62.99	70.05
37				X	X	X		X	85.81807**	62.99	70.05
38				X	X	X	X		74.14862	62.99	70.05
39			X		X	X		X	71.08737	62.99	70.05
40			X		X	X	X		64.7139	62.99	70.05
41	X			X	X			X	69.60524	62.99	70.05
42	X			X	X	X			66.17315	62.99	70.05
43	X			X	X			X	69.60524	62.99	70.05
44			X		X	X			45.80914	42.4845	48.45
45			X		X			X	44.32783	42.4845	48.45
46				X	X	X			56.77336	42.4845	48.45
47				X	X			X	51.39887	42.4845	48.45
48					X	X	X		44.72838	42.4845	48.45
	18	15	19	27	48	40	24	33			

* Null Hypothesis: No Cointegrating Vector.

** Rejecting Null Hypothesis of at most 1 Cointegrating Vectors.

3.5 Conclusion

This chapter has applied econometric techniques for the correlation and cointegration of time series to examine issues of short-term and long-term co-movements between stock markets before and after international and national events. In short, this chapter shows the existence of increasing short-term co-movements, but not long-term co-movements, among Asia-Pacific stock markets after financial deregulation. Another interesting finding is that Malaysia and Singapore are highly correlated with each other and with other markets in the region in both sub-periods.

A summary and the implications of the results from each test are as follows.

The findings from the correlation tests show that correlation between the stock price series increased considerably. Hence, Asia-Pacific stock markets appear to be more closely tied to one another in the short-term after financial deregulation. The findings also imply, as far as short-term investment is concerned, that the benefits of portfolio diversification diminished substantially within the region.

Tests for unit roots in eight Asia-Pacific stock markets show that all stock price series are integrated of order one, I(1), in both sub-periods. The results from cointegration tests in the first sub-period finds the existence of a "southern bloc" and it also indicates that there is long-term co-movement among Asia-Pacific stock markets. On the other hand, no evidence of cointegration is found in the second sub-period. The

implication is that long-term investment offers, in the second sub-period, greater benefit for risk reduction through diversification within the region.

Overall, the result of low correlation but cointergation in the first sub-period indicates that Asia-Pacific stock markets may follow different patterns in the short-term, but that in the long-term (or in the future, such as in the second period) they are closely linked. This finding is consistent with the evidence in the second sub-period which shows high correlation between Asia-Pacific stock markets.

Furthermore, the result of high correlation but no cointegration in the second sub-period indicates that the absence of cointegration simply rules out the existence of a long-run equilibrium tending relationship, but does not invalidate any short-run relationships which may arise due to profit-seeking opportunities in transactions.[169]

[169] See Masih and Masih (1995)

Chapter 4 Interdependencies among Asia-Pacific Stock Markets: Evidence using a Vector Autoregression Model

4.1 Introduction

National stock market activity is now, more than ever before, increasingly being exposed to pressures emanating from deregulation and globalization. This deregulation and globalization of financial transactions has led to the assertion that the behavior of national stock market (prices) during the crash of 1987 was influence by international events more than ever. Hence, studies on stock market interdependencies may provide new insights into the economic nature of the 1987 crash. Since the notion that high economic interdependence may be reflected in a high degree of co-movement of stock markets, therefore, it is particularly interesting to examine the interdependencies among Asia-Pacific stock markets since these countries have high economic interdependencies.

The main purpose of this chapter is to examine changes in price relations among Asia-Pacific stock markets before and after international as well as national events. Using a Vector Autoregression Model, it analyzes the degree to which a change in one country's stock price series exerts an influence on a change in other countries' stock price series and the time path of the latter. Hence, the major difference between this chapter on interdependencies and the earlier chapter on co-movement among national stock price series lies in the fact that this study of interdependencies examines the dynamic structure of stock price developments. First, the study looks at the effect which a shock

(innovation or news) in one stock market has on others. Then, it examines whether this pattern changed after the crash of October 1987 and discusses whether financial deregulation could be the reason for any such change. Furthermore, this study examines whether there is one or more dominant or particularly influential market within the region.[170]

In attempting to answer the above questions, an unrestricted vector autoregression (VAR) model is estimated. The VAR model is used to investigate the strength and persistence of the effects of a shock or innovation in one market on the other markets in the model. Two techniques of the VAR model, the Impulse Response Functions (IRF) and Variance Decompositions (VDC), are employed for interpreting the model. By using the simulated responses of the estimated VAR system, IRFs trace out the dynamic responses of each market to a shock in a particular market. The Variance Decompositions (VDC) determine the proportion of each variable's (i.e. market's) error that is attributable to each of the innovations in the VAR model.[171]

The organization of the chapter is as follows: the data and methodology are explained in sections 4.2 and 4.3 and the empirical results are reported in section 4.4. Section 4.5 offers a summary and concluding remarks.

---

[170] The definition of such a market is by asymmetry in its relation with others such that its price movement affects subsequent price movements in other markets but are not affected or less strongly affected by price movement of other markets. See Eun and Shim (1989).

[171] For an overview of the VAR approach, see Pagan (1987), and Charemza and Deadman (1992).

4.2 Data

The data used in the Vector Autoregressions (VAR) model consists of time series of daily stock market indices, in terms of local currency units, of the eight Asia-Pacific stock markets, namely Australia, Hong Kong, Japan, Korea, Malaysia, Singapore, Thailand, and Taiwan. Since a month or even a week may be long enough to conceal interactions that may last only for a few days, it is more appropriate to use daily data than monthly or weekly data in order to capture the potential interactions. The daily stock indices for each of the eight stock markets are transformed to daily rates of return by taking first differences of their logarithms.[172] [173]

The data cover the period from January 3, 1977, through January 30, 1998. To examine whether there have been changes in inter-relationships among stock prices in the Asia-Pacific stock markets pre- and post- October 1987 crash and before and after financial deregulation, the sample excludes the data covering the period of the crash and is thus divided into two sub-periods (January 03, 1977 to December 30, 1986 and January 03, 1988 to January 30, 1998).

In addition, the stock markets within the region operate in different time zones, but with only a small gap between them. Therefore, the implications of using this overlapping data should be considered while interpreting the empirical results.[174]

---

[172] See Granger and Morgenstern (1970) for the transformation of variables to changes in logarithms.

[173] For the argument of using stock indices as in level or return, see Doan (1992) for details.

4.3 Methodology

A Vector Autoregression is a system of equations that makes each endogenous variable a function of its own past values and the past values of the other endogenous variables in the system. A virtue of the VAR model is its simplicity of method - it is not necessary to specify certain variables as endogenous or exogenous, and each equation can be estimated by OLS separately.[175] However, before the estimation of VAR, the following issues need be considered:

(I) Differencing

In a VAR analysis, the issue of whether the variables need to be stationary exists. In general, three cases are possible: (i) if all variables are trend stationary, then the application of an unrestricted VAR in 'levels' is appropriate; (ii) if no cointegrating relationship exists, then the application of an unrestricted VAR in 'first differences' is appropriate; and (iii) if at least one integrated variable and one cointegrating relation are present, then the data can be described as an error-correction model.[176] Since most of the

---

[174] See also Section 3.2 for more details.

[175] See Sims (1980 and 1982) and see also Cooley and LeRoy (1985) for an important critique.

[176] The main argument against differencing is that differencing data may not able to capture the information concerning the co-movements in the data. However, Doan (1992) recommends against differencing even if the variables contain a unit root. He argues that the goal of VAR analysis is to determine the inter-relationship among the variables, not the parameter estimates.

stock price series in this study are found to be I(1) and no cointegrating relationship exists in the second period,[177] the application of an unrestricted VAR in first differences is appropriate for this study.[178]

(II) Lag Length

One practical challenge in VAR modeling is to choose the appropriate lag length. The concern is that policy recommendations derived from VAR analysis can be quite sensitive to the lag length employed, and hence, the estimation of an unnecessarily long lag length may consume many degrees of freedom.[179] In this study, the lag length of the VAR is chosen to be 5 trading days, which is equivalent to one normal week.[180]

(III) Ordering

McMillin (1991) argues that differences in the order of the variables can have quite a sensitive effect on the pattern of response in the VAR analysis and it may

---

[177] See chapter 3 of this study.

[178] Alternative models with data in level have also been estimated over the sample period. The results of the two models, in level and in first difference, are qualitatively similar.

[179] The longer the lag length, the larger the number of parameters to be estimated.

[180] Alternative models with different lag lengths have also been tested, and the results are qualitatively similar. However, this study tests formally one overall lag length versus another by using the lag length testing programme in RATs. A VAR with 5 (10, 15, 20) lags in each variable against 10 (15, 20) lags is tested. The hypothesis that the restriction of excluding 6 through 10 lags cannot be rejected, at the usual 5 percent significance level. Moreover, the results are robust for different lag length pairs. All in all, there seems to be little or no feedback to the current stock market returns from returns lagged more than 5 days.

produce major alterations in its properties. On the other hand, some have argued that the ordering of variables matters only if, and to the extent that, the errors are contemporaneously correlated. Hence, the ordering is insignificant if the errors are uncorrelated, so that no re-normalization is needed to diagonalize the error covariance matrix. In this study the markets are placed in this order according to the market capitalization of each country: Japan, Hong Kong, Australia, Malaysia, Taiwan, Singapore, Korea, and Thailand.[181] The rationale for this ordering is the assumption that the market with higher capitalization is more likely to dominate the other markets and less likely to respond contemporaneously to innovations in the other stock markets.[182]

Overall, this study tackles the above problems by using the data in first differences rather than in levels. To check the seasonality, the regular peaks in the autocorrelation function have been examined, and no seasonality is found to exist in the VAR system. The lag length is tested and five trading days is chosen, and the LM test is used to ensure there is no serial correlation on each equation with five lags.

---

[181] According IFC, in 1996, the market capitalizations (in US$ millions) of each Asia-Pacific stock market was: Japan (3,088,850); Hong Kong (449,318); Australia (311,998); Malaysia (307,179); Taiwan (273,608); Singapore (150,215); Korea (138,817); and Thailand (99,828).

[182] Some alternative orderings, such as ordering according to the sequence of business hours, are also tested. The different ordering tests yield similar results with just one difference that whichever in the first order yields the higher degree of response from other markets. However, when compare all the tests in which each country, taken in turn, be placed first in the order, the results show that Malaysia, Singapore, Hong Kong, Australia, and Japan, respectively, yield a high degree of response from other markets. In addition, an alternative method, the generalized impulse response analysis, which has the property of being invariant to the ordering of variables in the VAR model, is also applied in this study.

4.3.1 Model Estimation

The VAR model is used to examine the eight variables that are daily stock market indices in first difference in two sub-periods among the Asia-Pacific countries. It is expressed as:

$$Y_t = a_0 + \sum_{i=1}^{p} \Phi_i Y_{(t-i)} + e_t \qquad [4.3.1\text{-}1]$$

Where

Y_t: an 8x1 column vector of daily stock indices in level

Φ_i: an 8x8 matrix of coefficients

a_0: an 8x1 matrix of coefficients

p: lag length

e_t: an 8x1 column vector of forecast errors of the best linear predictor of Y_t using all the past Y_s

Since the estimated coefficients of the regression equations in VAR contain complicated cross-equation feedbacks, it is difficult to interpret these coefficients intuitively. Therefore, to draw conclusions about a VAR, it is better to analyze the system's reaction to typical random shocks, using the techniques of impulse response functions (IRFs) and variance decompositions (VDCs). The next section provides a discussion of IRFs and VDCs.

4.3.2 Impulse Response Function and Variance Decomposition

There are two different ways of computing Impulse Response Functions (IRFs) and Variance Decompositions (VDCs): the orthogonalized method and generalized method.

(I) Othogonalized approach

An impulse response function, which separates the determinants of the stock returns, traces the response of the stock returns in the system to shocks in the errors.[183] It then traces the effects on current and future values of the stock returns of innovations measured as one standard deviation shocks. Impulse response functions work with the m x m (8 x 8) coefficient matrices, A_j, in the infinite moving average representation of [4.3.1-1]

$$Y_t = \sum_{j=0}^{x} A_j \; e_{(t-j)}, \qquad [4.3.1\text{-}2]$$

where the matrices, A_j, are computed using the recursive relations

$$A_j = \Phi_1 A_{j-1} + \Phi_2 A_{j-2} + \; + \Phi_p A_{j-p}, \qquad j = 1,2,\ldots \qquad [4.3.1\text{-}3]$$

with $A_0 = I_m$, and $A_j = 0$, for $j < 0$.

---

[183] That is a change in error, e_t or a innovation, in market 1 will immediately change the value of market return, Y_t, in market 1. It will also change all future values of market return in all markets due to the dynamic structure of the system.

The orthogonalized impulse response function (OI), based on the Choleski decomposition, is advanced by Sims (1980). The OI innovation attributes all of the effect of any common component to the variable that is ordered first in the VAR system.[184] To illustrate the Choleski decomposition[185] Σ (e.g. the covariance matrix of the shock, e_t), that:

$\Sigma = T\,T'$, where T is a lower triangular matrix. Rewrite the moving average representation as:

$$Y_t = \sum_{j=0}^{\infty} A_j^* \varepsilon_{(t-j)}, \qquad [4.3.1\text{-}4]$$

where $A_j^* = A_j T$, and $\varepsilon_t = T^{-1} e_t$. Then, the orthogonalized impulse response function of a unit shock at time t to the i *th* orthogonalized error, namely εit , on the j *th* variable at time t + N is given by the j *th* element of:

$$A_N^* u_i = A_N T u_i, \qquad [4.3.1\text{-}5]$$

where u_i is the m x 1 (8 x 1) selection vector, $u_i = (0,0,\ldots 0,1,0,\ldots 0)'$. Hence, the orthogonalized IR function is:

$$OI_{ij,N} = u_j' A_N T u_i, \qquad i, j, = 1,2, \ldots,m \qquad [4.3.1\text{-}6]$$

---

[184] This means that the common component of e_t in market 1 and 2 is totally attributed to e_t in market 1, because e_t in market 1 precedes e_t in market 2; transformed to remove the common component.

[185] For a detailed description of Choleski decomposition, see Enders (1995), pp.302-303.

Furthermore, the Orthogonalized Variance Decomposition (OVDCs) shows the proportion of the movements in a sequence due to its 'own' shocks versus shocks to the other markets.[186] The OVDCs for the i *th* variable in the VAR is given by:

$$OVDC_{ij,N} = \frac{\sum_{\kappa=0}^{N} (u_i' A_\kappa T u_j)^2}{\sum_{\kappa=0}^{N} u_i' A_\kappa \Sigma A_\kappa' u_i}, \qquad i, j = 1,2,\ldots m \quad [4.3.1\text{-}7]$$

Notice that $u_i' A_\kappa \Sigma A_\kappa' u_i$ is simply the i th diagonal element of the matrix $A_\kappa \Sigma A_\kappa'$. Hence, $OVDC_{ij,N}$ measures the proportion of the N-step ahead forecast error variance of variable i, which is accounted for by the orthogonalized innovations in variable j. (Lee and Pesaran, 1993).

However, the Othogonalized approach provides a measure of the overall relative importance of the markets in generating the fluctuations in stock returns in their own and other markets. The Othogonalized approach is, nonetheless, an arbitrary method of attributing common effects, for the impulse response functions and variance decompositions depend critically on the ordering of equations and care should be given to interpreting the result of OI and OVDCs.

---

[186] That is if et in market 2 explains none of the error variance of market 1 at any time, then market 1 is exogenous. In such a circumstance, market 1 is said to be independent of market 2 and et in market 2.

(II) Generalized Approach

To circumvent the drawback of being sensitive to the ordering of the variables in the VAR model, Pesaran and Shin (1997) proposed generalised impulse response analysis for linear multivariate time series models. [187] In the case of the generalized impulse response function, the VAR model has the infinite moving-average representation:

$$GI_Y (N, e_t^0, \Omega_{t-1}^0) = A_N u_t^0 \qquad [4.3.1\text{-}8]$$

Considering the effect of a variable-specific shock on the evolution of Y_{t+1}, Y_{t+2} , ... Y_{t+N} , the VAR model is perturbed by a shock of size $\delta_i = \sqrt{\sigma_{ii}}$ to its i *th* equation at time t. Then, the Generalized impulse response function which is history invariant (i.e. does not depend on Ω_{t-1}^0) is represented as:

$$GI_Y (N, \delta_i, \Omega_{t-1}^0) = A_N E(u_t | \ u_{it} = \delta_i) \qquad [4.3.1\text{-}9]$$

Hence, the generalized impulse response function of a unit shock to the i *th* equation in the VAR model on the j *th* variable at horizon N is expressed as:

$$GI_{ij,N} = u_j' A_N \Sigma u_i \ / \ \sqrt{\sigma_{ii}} \qquad i, j, = 1,2,...m \qquad [4.3.1\text{-}10]$$

Furthermore, the Generalized Variance Decomposition (GVDCs) consider the proportion of the variance or the N-step forecast errors of Y_t, which is explained by

[187] For further detail of generalized impulse response analysis, see also Koop, Pesaran and Potter (1996) and Coakley and Fuertes (1997).

conditioning on the non-orthogonalized shocks, $e_{i\,t}$, $e_{i,t+1}$, ..., $e_{i,\,t+N}$, but explicitly to allow for the contemporaneous correlations between these shocks and the shocks to the other equations in the system. The GVDCs for the i *th* variable in the VAR is given by:

$$GVDC_{ij,N} = \frac{\sigma_{ii}^{-1} \sum_{\kappa=0}^{N} (u_j' A_\kappa \Sigma u_i)^2}{\sum_{\kappa=0}^{N} u_i' A_\kappa \Sigma A_\kappa' u_i}, \quad i, j = 1,2,\ldots m \quad [4.3.1\text{-}11]$$

Note that the denominator of this measure is the same as the denominator of the orthogonalized forecast error variance decomposition formula (OVDCs), in [4.3.1-7]. In general the two decompositions differ with exception that the first variable in the VAR and/or Σ is diagonal. Yet, in contrast to orthogonalized impulse response functions, generalized impulse response functions are invariant to the ordering of variables in the VAR model.

4.4 Empirical Results

This section reports the results of the dynamic simulations which are used to calculate the impulse response functions and the variance decompositions in the VAR models. The Impulse Response Functions (IRFs) results show the response of each market to all innovations or news in other markets, and the Variance Decompositions (VDCs) give the percentage of the variance due to specific innovations.

However, this study has applied both the orthogonalized and the generalized approaches in the VAR analysis. Note that although a few cases (e.g. Singapore and Malaysia) have been found in which their initial impacts in the generalized approach are moderately bigger than orthogoalized approach, the results in both approaches, generally speaking, have no difference. This appears to justify the ordering of the VAR model in this study. Hence, another explanation would be that the errors are uncorrelated and no re-normalization is needed to diagonalize the error covariance matrix. If so, then, it implies that the ordering is insignificant. Since the results from both approaches are similar, this section has reported only the results from the orthogonalized method.

4.4.1 Othogonalized Impulse Response Function (OI)

The combined response graphs of Orthogonalized Impulse Response Function (OIs), which show how responsive a market is to one standard deviation innovations in other markets, are reported in Figure 4.4.1-1 for sub-period 1 and Figure 4.4.1-2 for sub-period 2.

From the combined response graph of OIs, the different response of one particular market to innovations in the various other markets for both sub-periods is clear. First, the findings show that the response of each market to one standard deviation innovations in other markets tapers off after the second day in both periods, indicating that on a daily basis a shock in a market has been transmitted to other markets very quickly. Hence, the findings show that the information is released in a short period of time, and stock prices adjust quickly to all relevant information.

Second, when we compare the IRFs before and after the 1987 crash, the response of each market to a shock increased slightly in the later period, but not much for Japan and Korea. Singapore and Malaysia have a high rate of response to all shocks from other markets, especially for the second sub-period. This may be explained by the high degree of market openness in the Singaporean and Malaysian markets. Hence, this increased sensitivity of stock prices to innovations in other markets can be evidence of the effects of financial deregulation in the region.

The multiple graphs of OIs for each market (which show how one standard deviation innovations in a particular market cause responses in other markets, [188]) are reported in Figure 4.4.1-1a to -1h for sub-period 1 and Figure 4.4.1-2a to -2h for sub-period 2.

Apart from the responses to an innovation in their own market (which in all cases yielded the highest degree of sensitivity), in general, the results show that each market tends to be quite sensitive in response to a shock or innovation in Japan and in Hong Kong for both periods. Thus, the responses to a shock in Japan and Hong Kong appear to have increased in sensitivity after financial deregulation.

There is no response in the first sub-period and less responsiveness in the second sub-period of other markets to a shock in Australia and Malaysia. Furthermore, no response of any market to a shock in Korea, Singapore, Taiwan or Thailand was found in either sub-period.

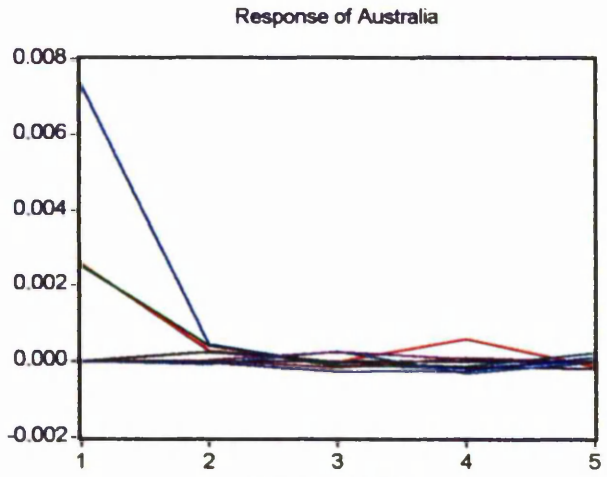
As far as each individual country is concerned, Japan is not responsive to a shock in any other markets, while Hong Kong only responds to a shock in Japan. According to this finding, therefore, Japan and Hong Kong are, perhaps, both influential markets in the region. There is less response of other markets to a shock in Malaysia, in fact only

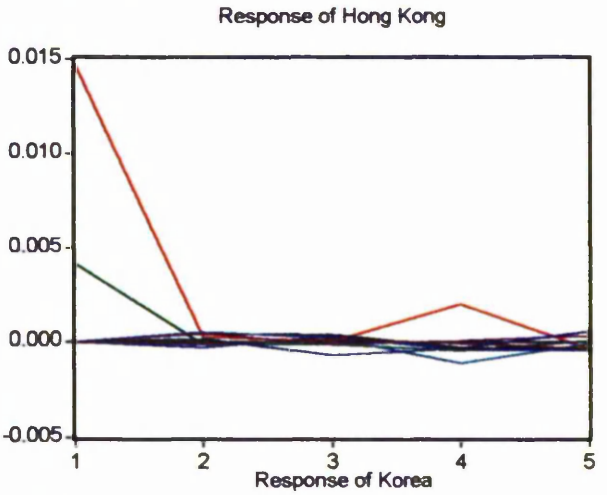
[188] In the multiple graphs of OIs (as figure 4.4.1-1a to 1h and figure 4.4.1-2a to 2h) for each individual market, the solid lines represent the point estimates of the OIs of each market to a standard deviation shock to the other markets in the system, while the broken lines indicate the two-standard deviation band around the point estimates. Hence, the effect of a shock is insignificant when the two-standard deviation band includes zero.

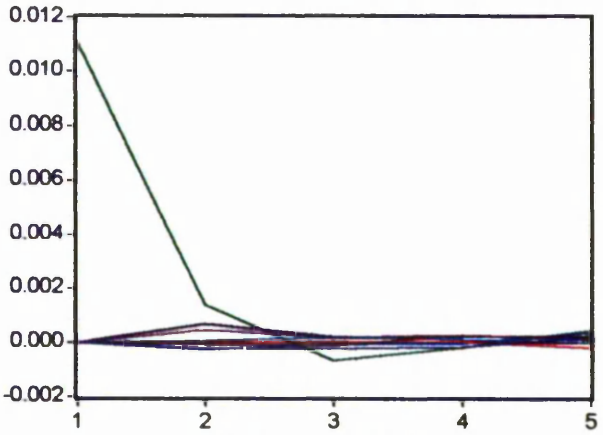
Singapore and Thailand appear to respond to a shock in Malaysia. Furthermore, a one-standard deviation shock in Malaysia has great influence on Singapore, but a one-standard deviation shock in Singapore does not have such influence on Malaysia.

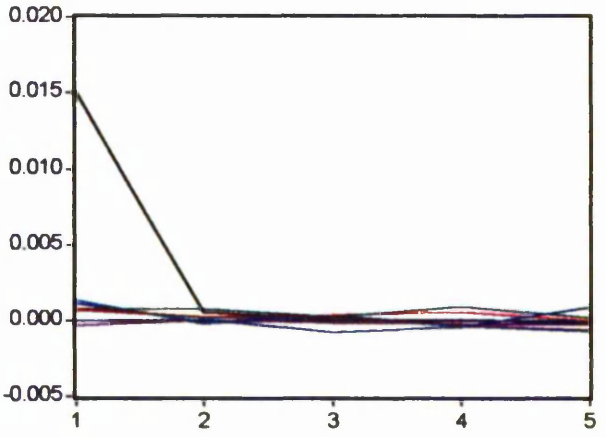
Two interesting cases in the one-standard deviation graphs are Singapore and Thailand. The results show that these two markets are highly influenced by other markets, but have almost no influence on others. On the other hand, Korea and Taiwan show a high response to an internal shock and no influence by other markets. This may imply that these two markets are very independent and have operated under a high degree of government control or intervention.

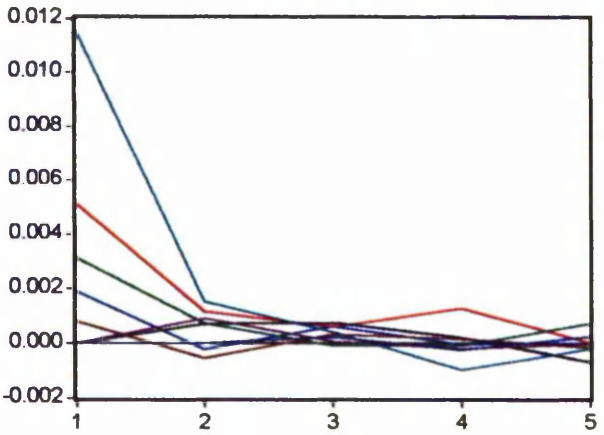
Figure 4.11.2 Orthogonalised Impulse Response to One S.D. Innovations (Sub-period 2)

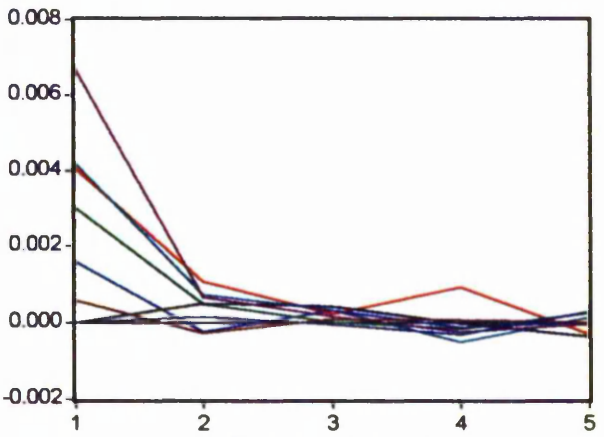


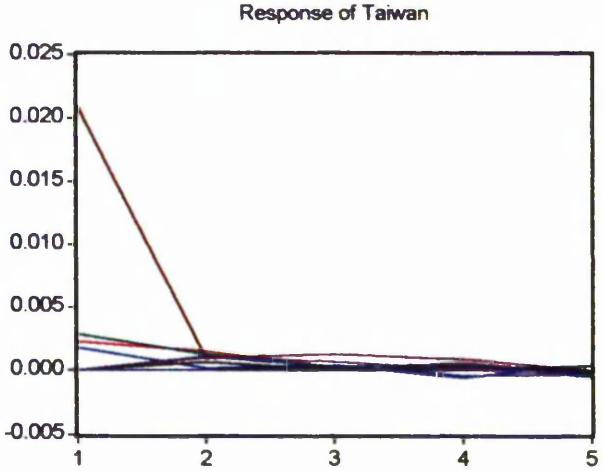












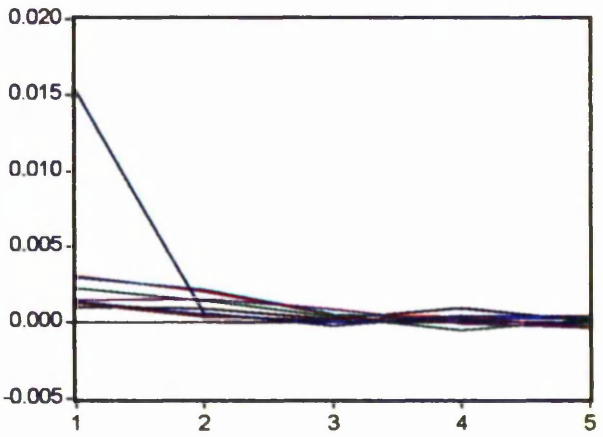


Figure 4.4.1-1a Orthogonalised Impulse Responses to Australia One S.D. Innovations +/- 2 S.E. (Sub-period 1)

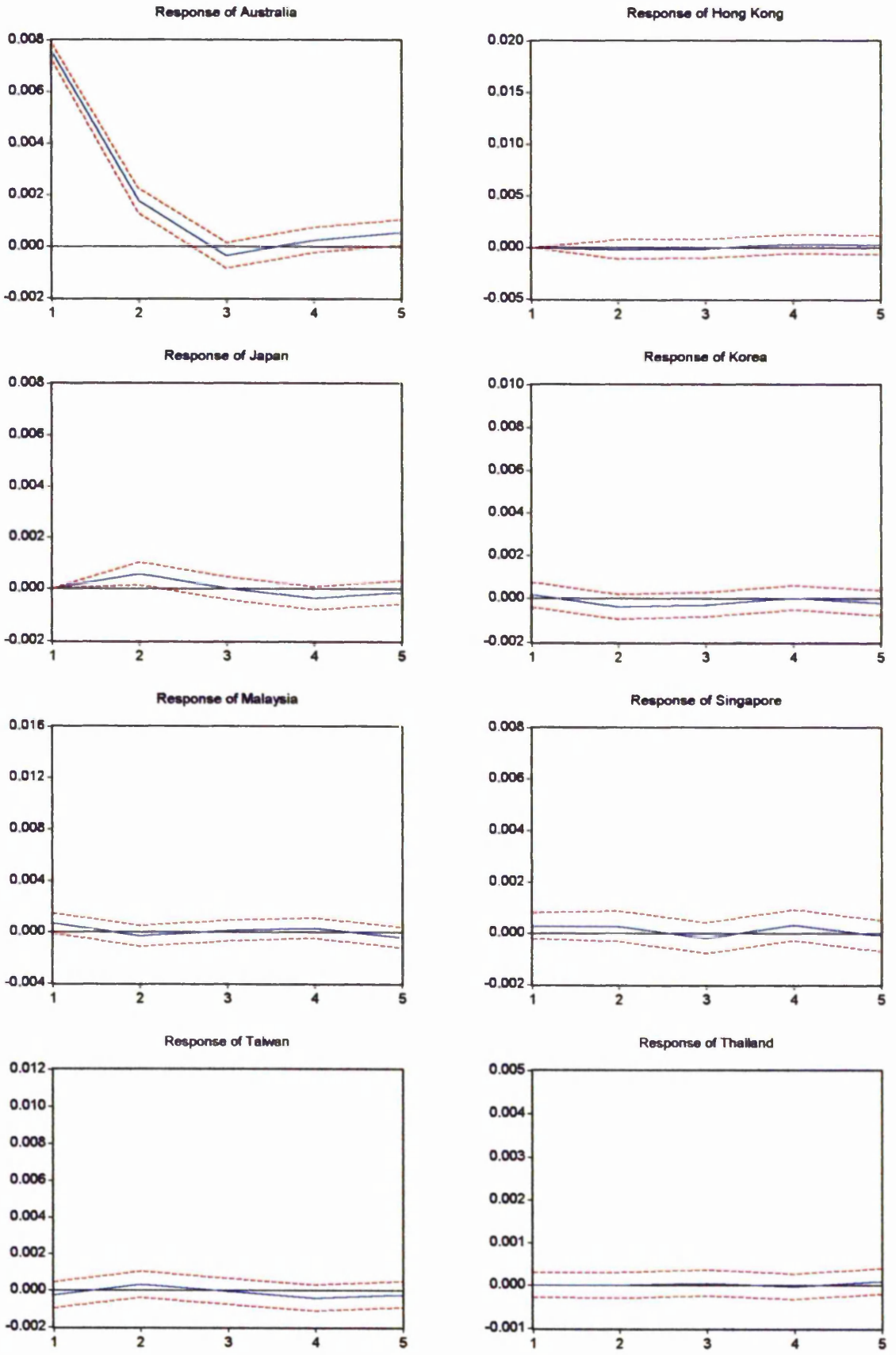


Figure 4.4.1-2a Orthogonalised Impulse Responses to Australia One S.D. Innovations +/- 2 S.E. (sub-period 2)

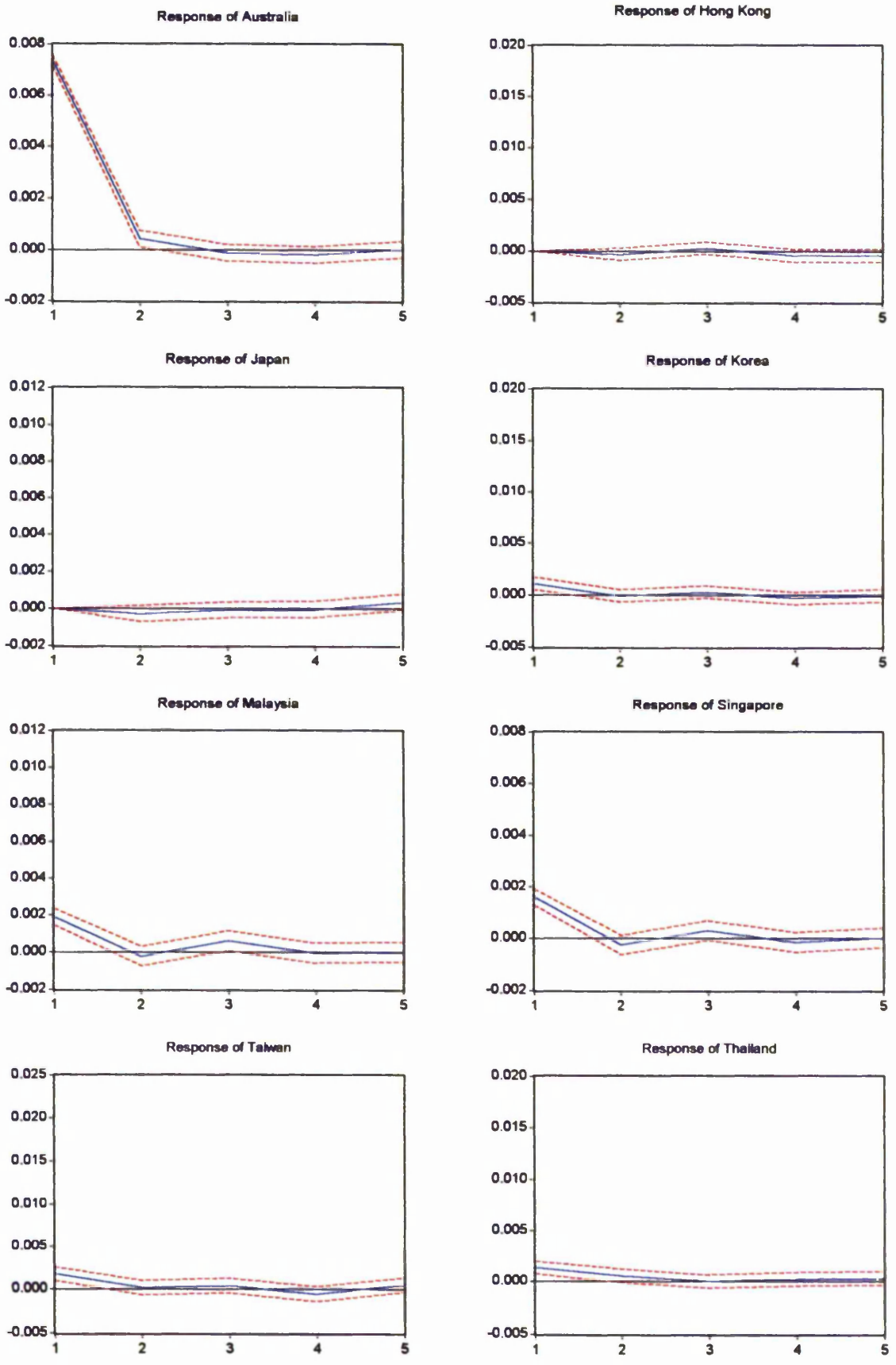


Figure 4.4.1-1b Orthogonalised Impulse Responses to Hong Kong One S.D. Innovations +/- 2 S.E. (Sub-period 1)

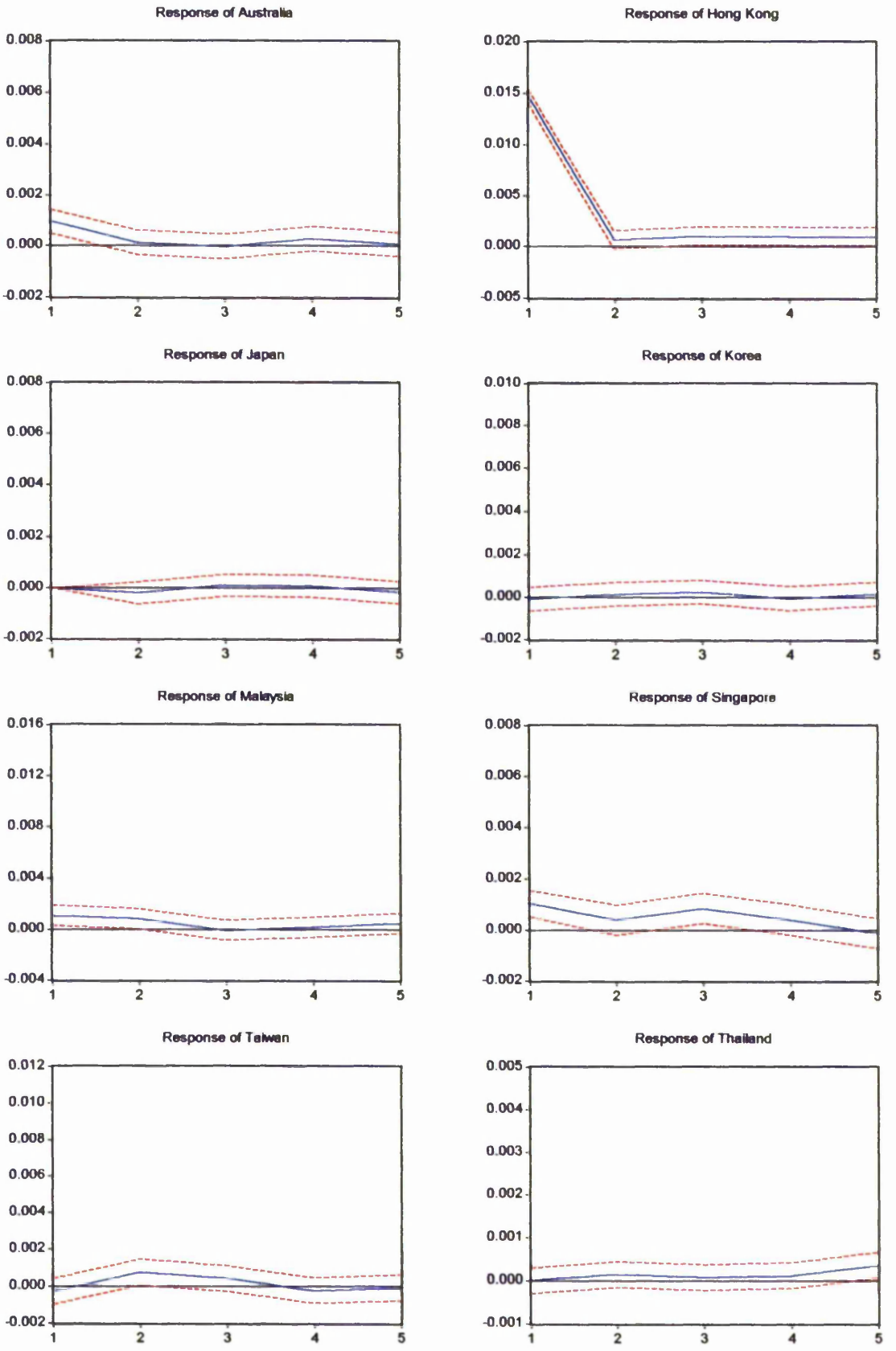


Figure 4.4.1-2b Orthogonalised Impulse Responses to Hong Kong One S.D. Innovations +/- 2 S.E. (Sub-period 2)

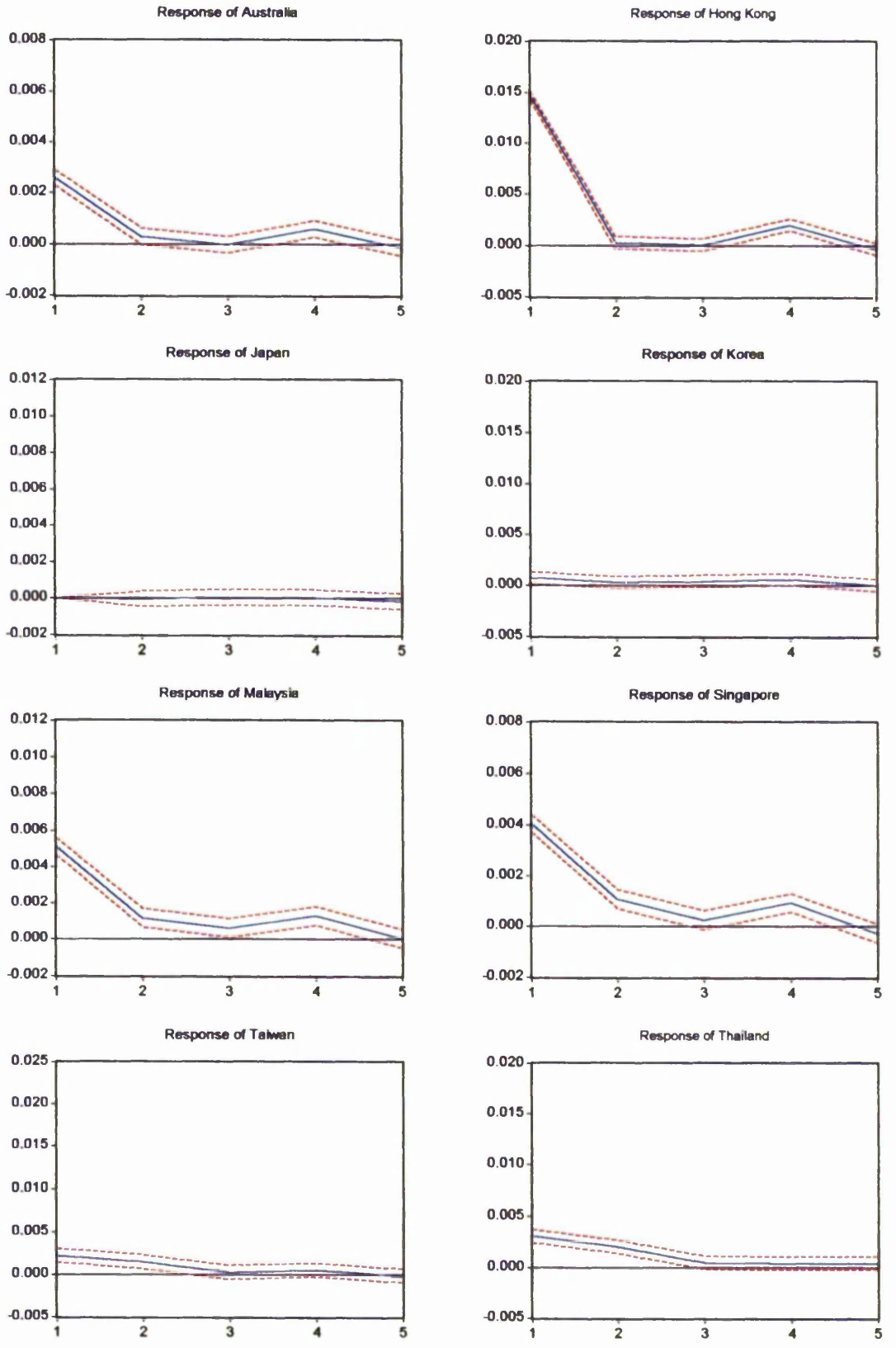


Figure 4.4.1-1c Orthogonalised Impulse Responses to Japan One S.D. Innovations +/- 2 S.E. (Sub-period 1)

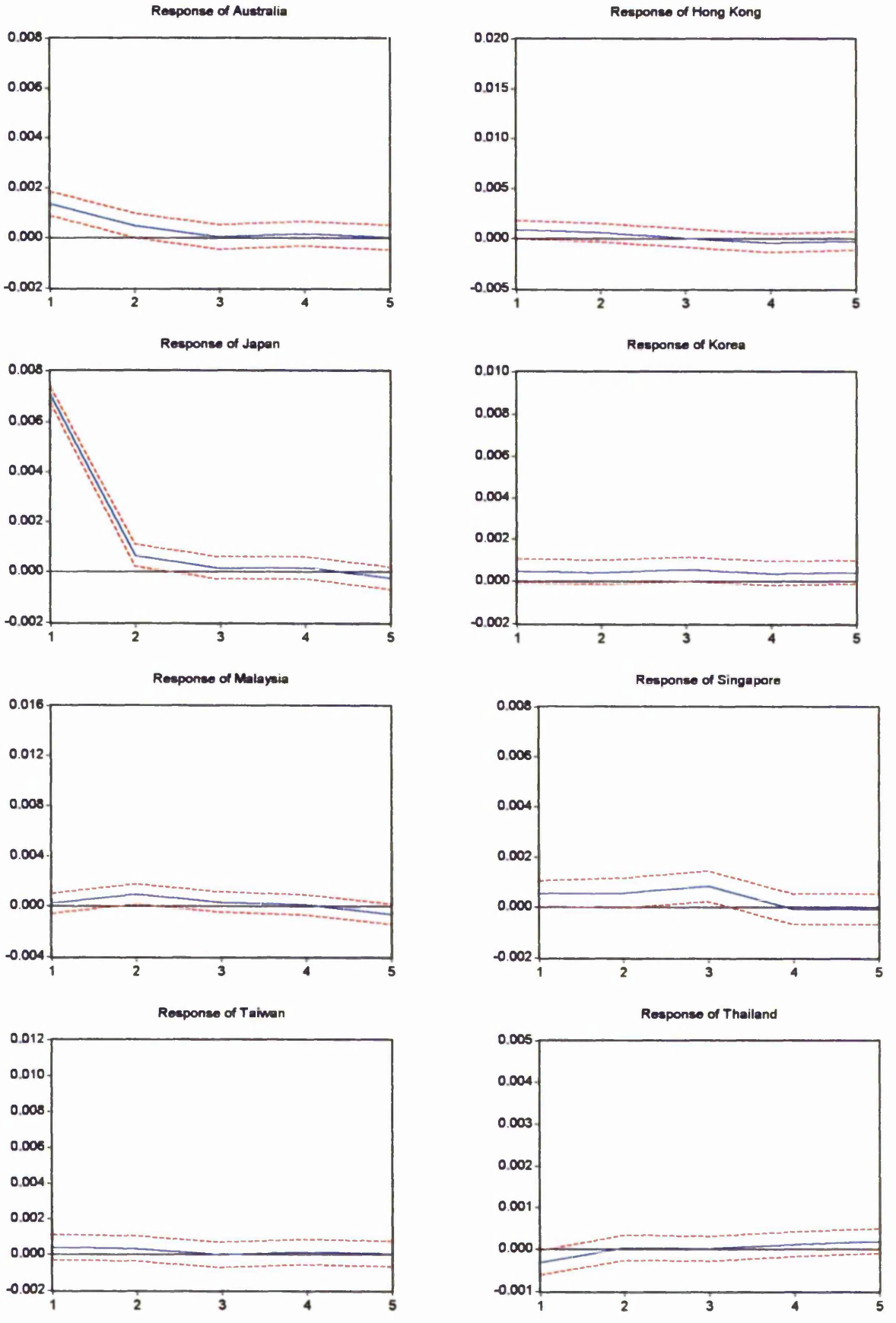


Figure 4.4.1-2c Orthogonalised Impulse Responses to Japan One S.D. Innovations +/- 2 S.E. (Sub-period 2)

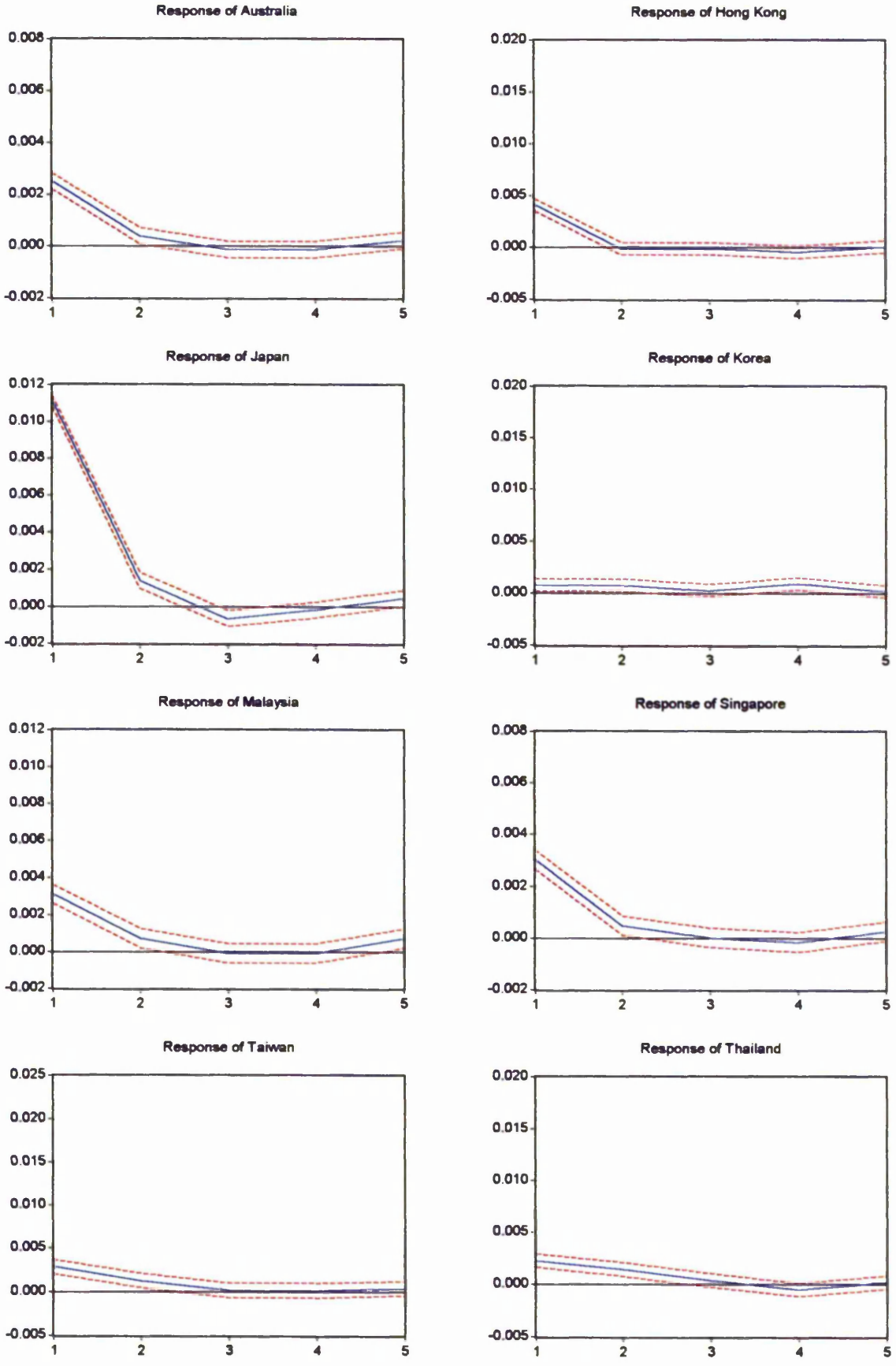


Figure 4.4.1-1d Orthogonalised Impulse Responses to Korea One S.D. Innovations +/- 2 S.E. (Sub-period 1)

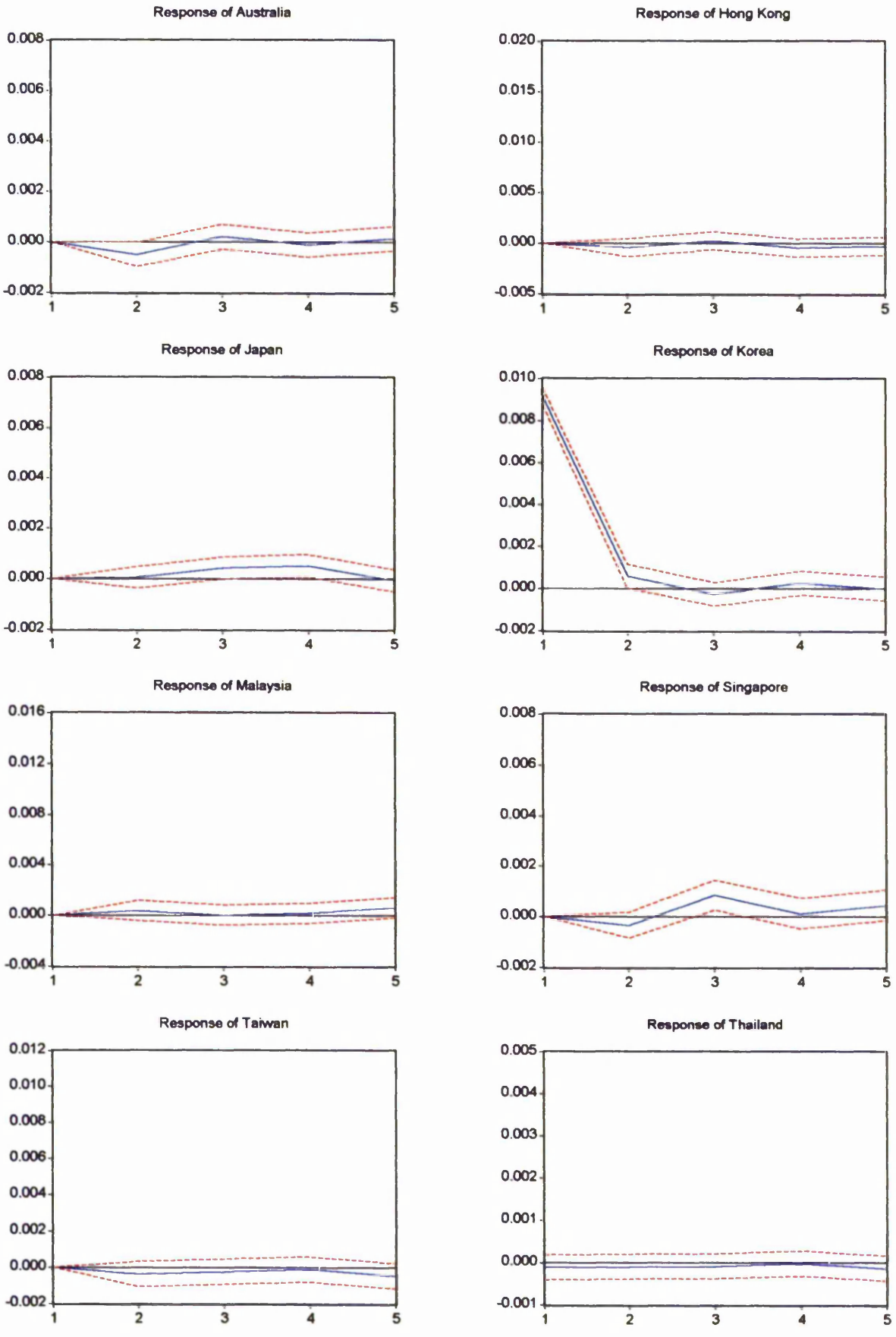


Figure 4.4.1-2d Orthogonalised Impulse Responses to Korea One S.D. Innovations +/- 2 S.E. (Sub-period 2)

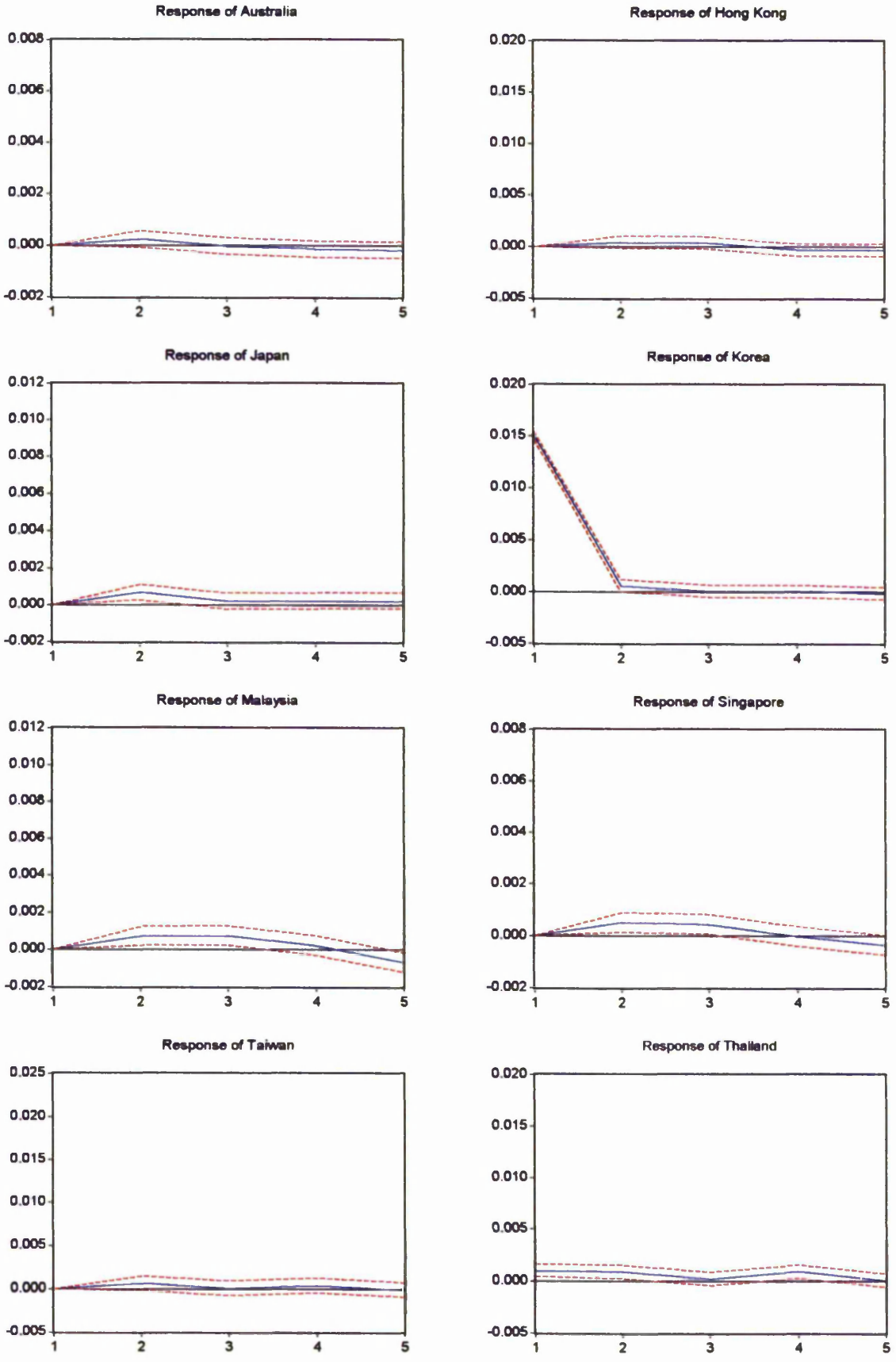


Figure 4.4.1-1e Orthogonalised Impulse Responsed to Malaysia One S.D. Innovations +/- 2 S.E. (Sub-period 1)

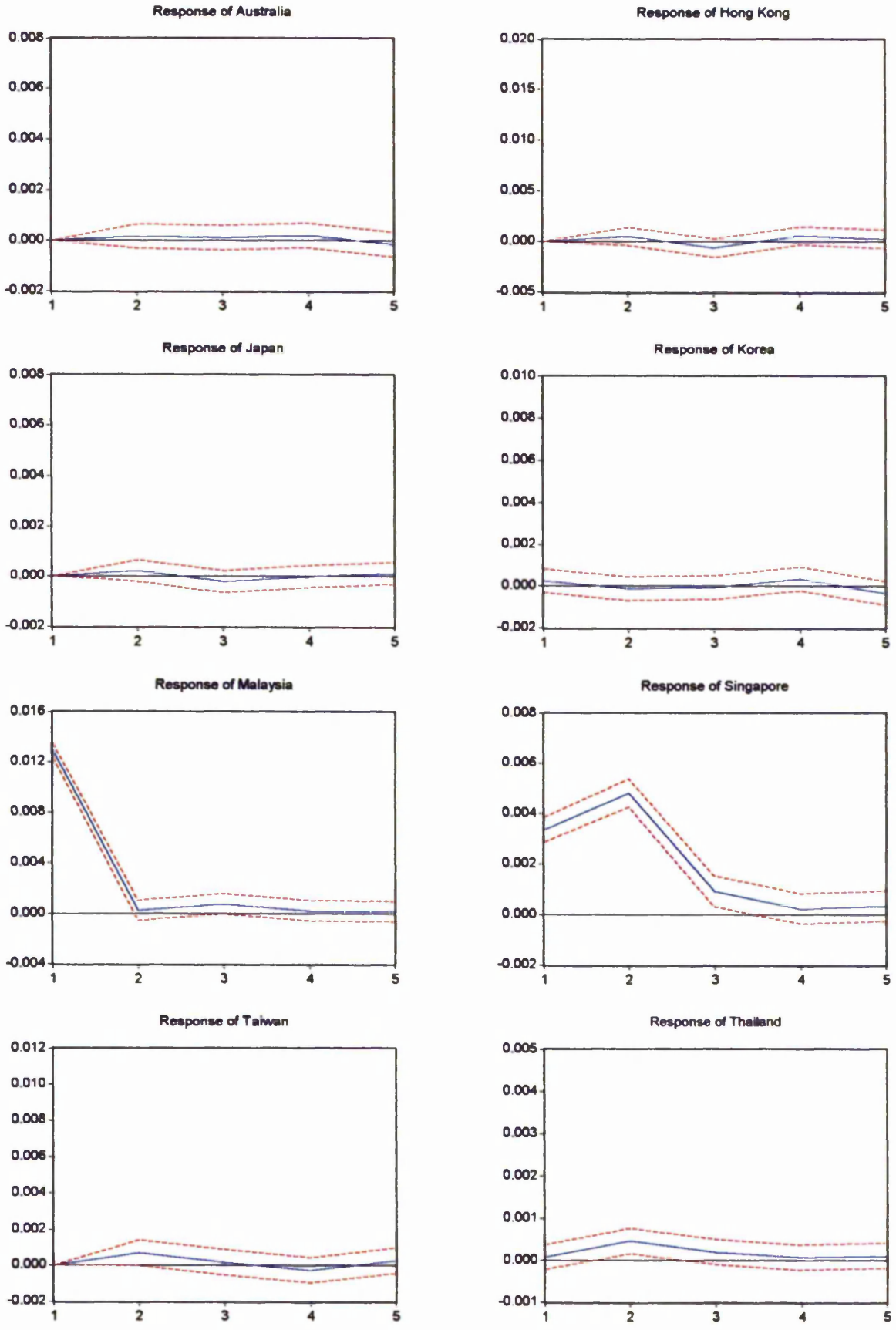


Figure 4.4.1-2e Orthogonalised Impulse Responses to Malayisa One S.D. Innovations +/- 2 S.E. (Sub-period 2)

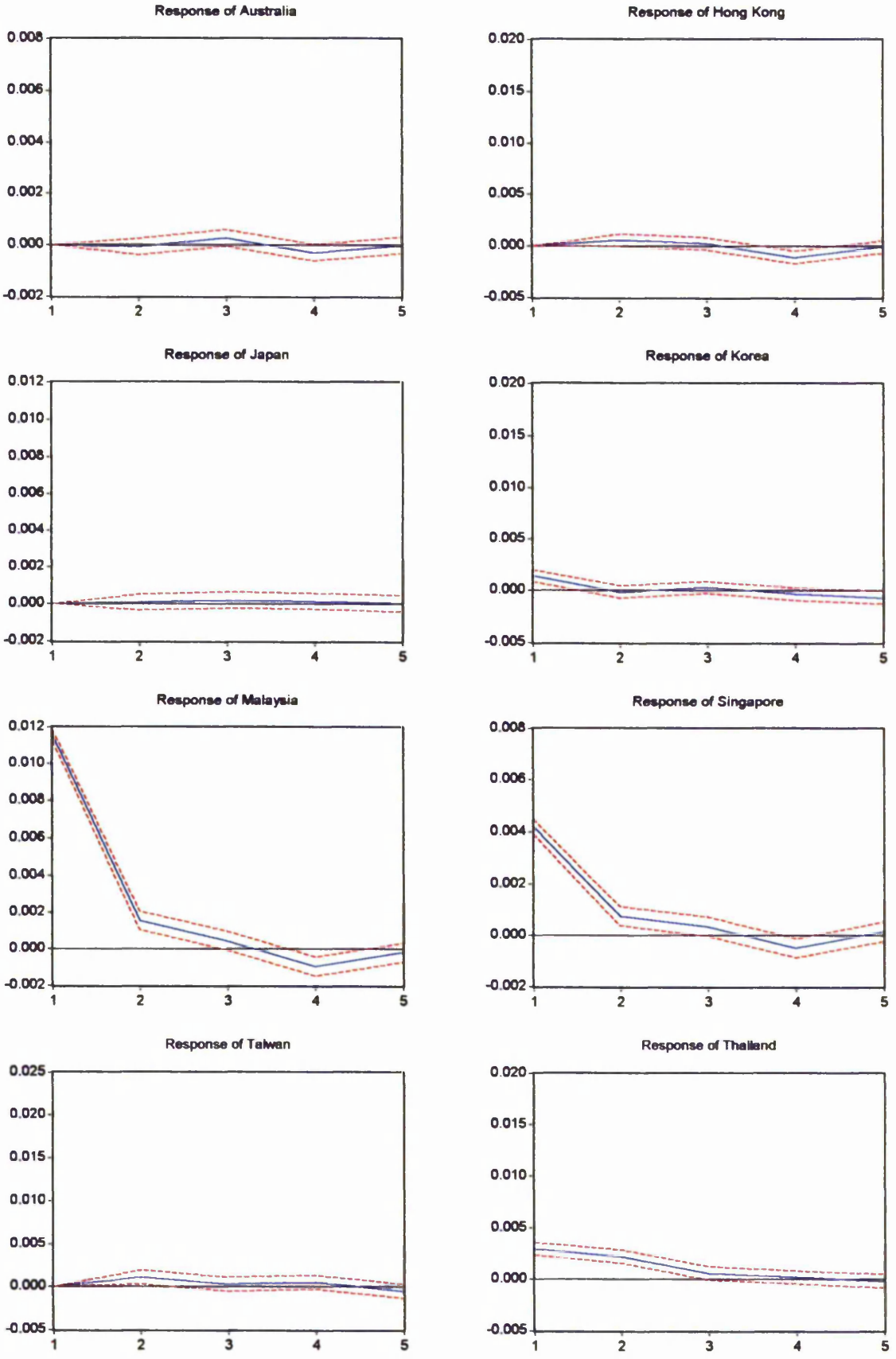


Figure 4.4.1-1f Orthogonalised Impulse Responses to Singapore One S.D. Innovations +/- 2 S.E. (Sub-period 1)

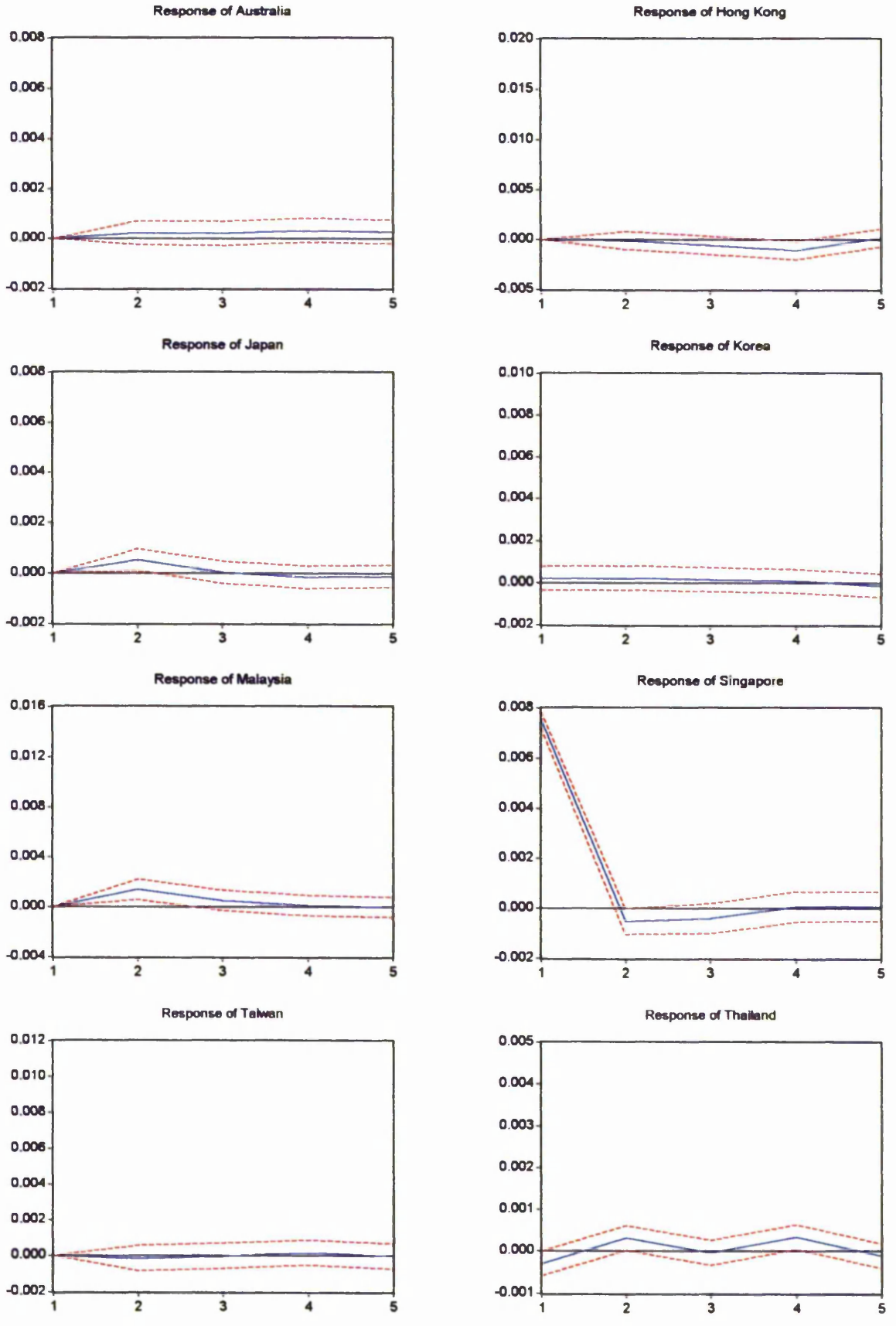


Figure 4.4.1-2f Orthogonalised Impulse Responses to Singapore One S.D. Innovations +/- 2 S.E. (Sub-period 2)

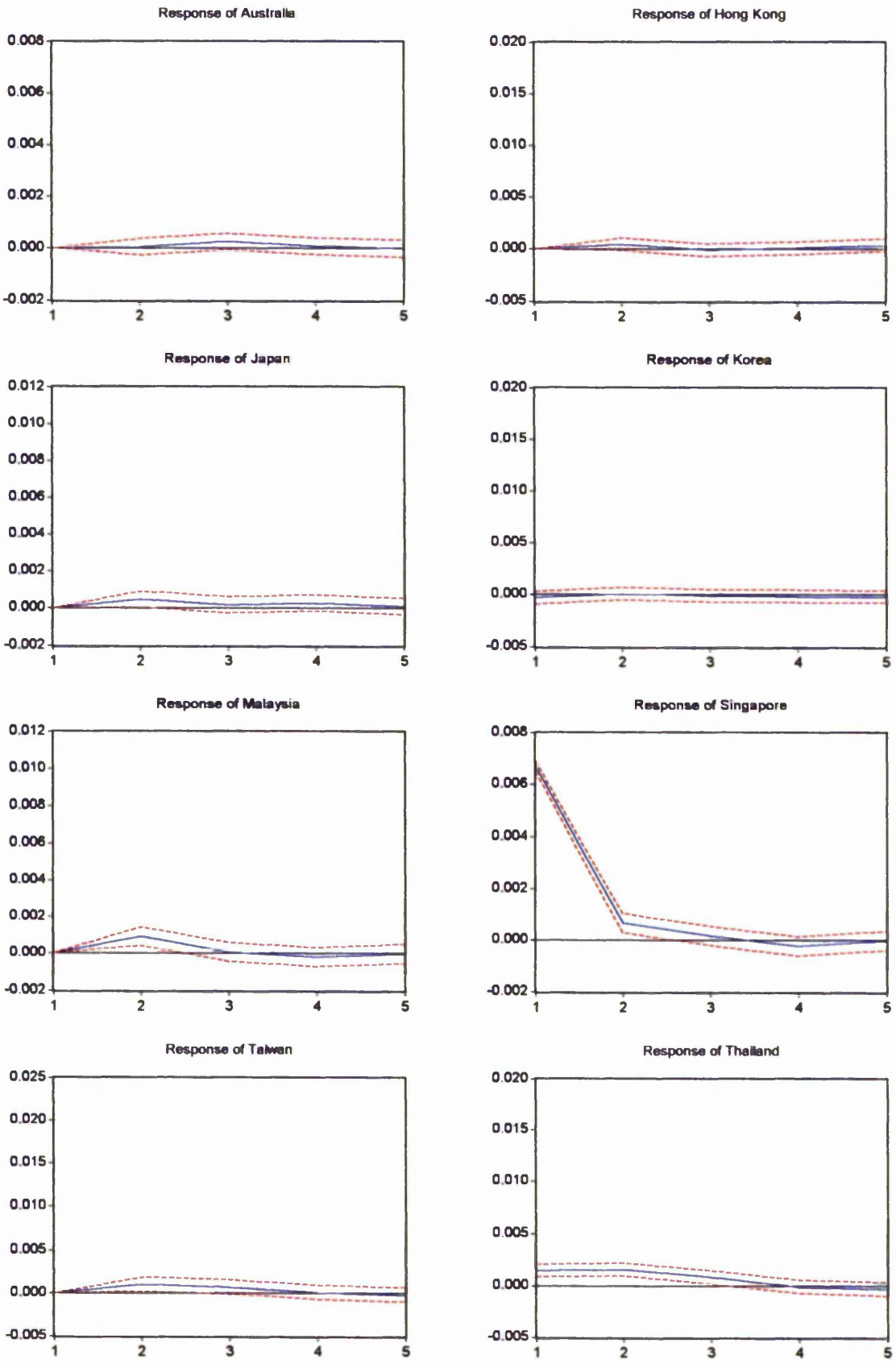


Figure 4.4.1-1g Orthogonalised Impulse Responses to Taiwan One S.D. Innovations +/- 2 S.E. (Sub-period 1)

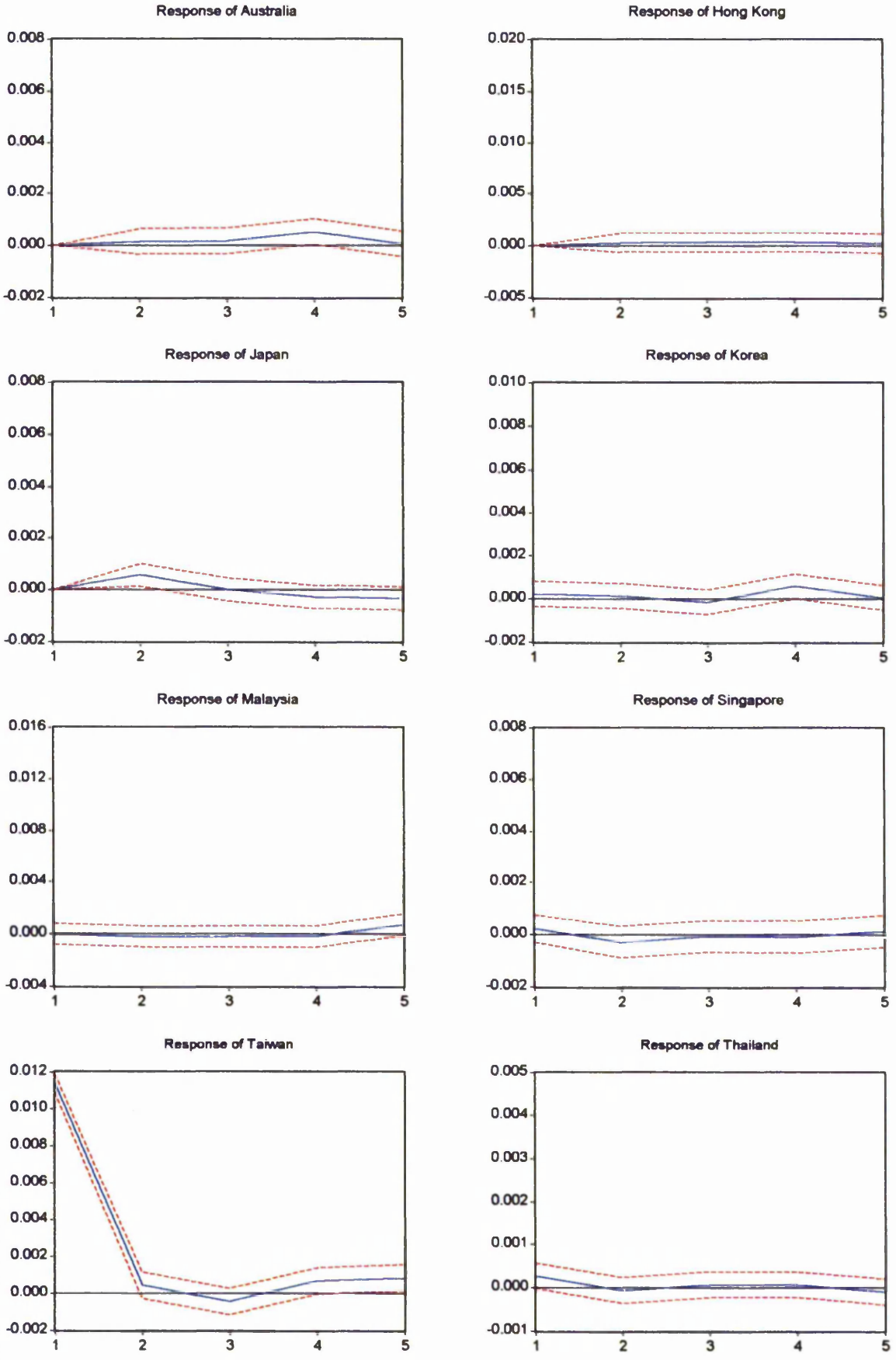


Figure 4.4.1-2g Orthogonalised Impulse Responses to Taiwan One S.D. Innovations +/- 2 S.E. (Sub-period 2)

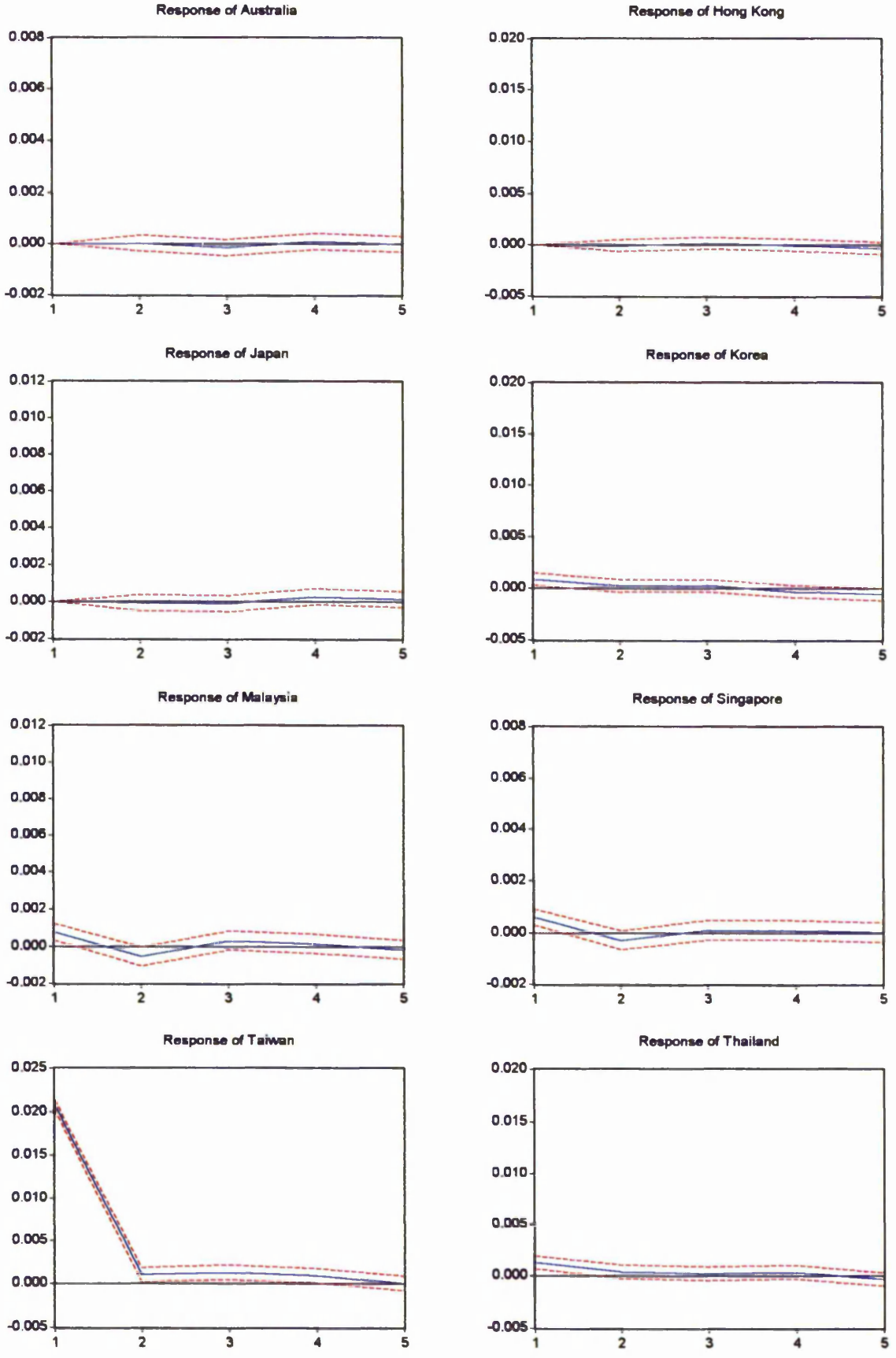


Figure 4.4.1-1h Orthogonalised Impulse Responses to Thailand One S.D. Innovations +/- 2 S.E. (Sub-period 1)

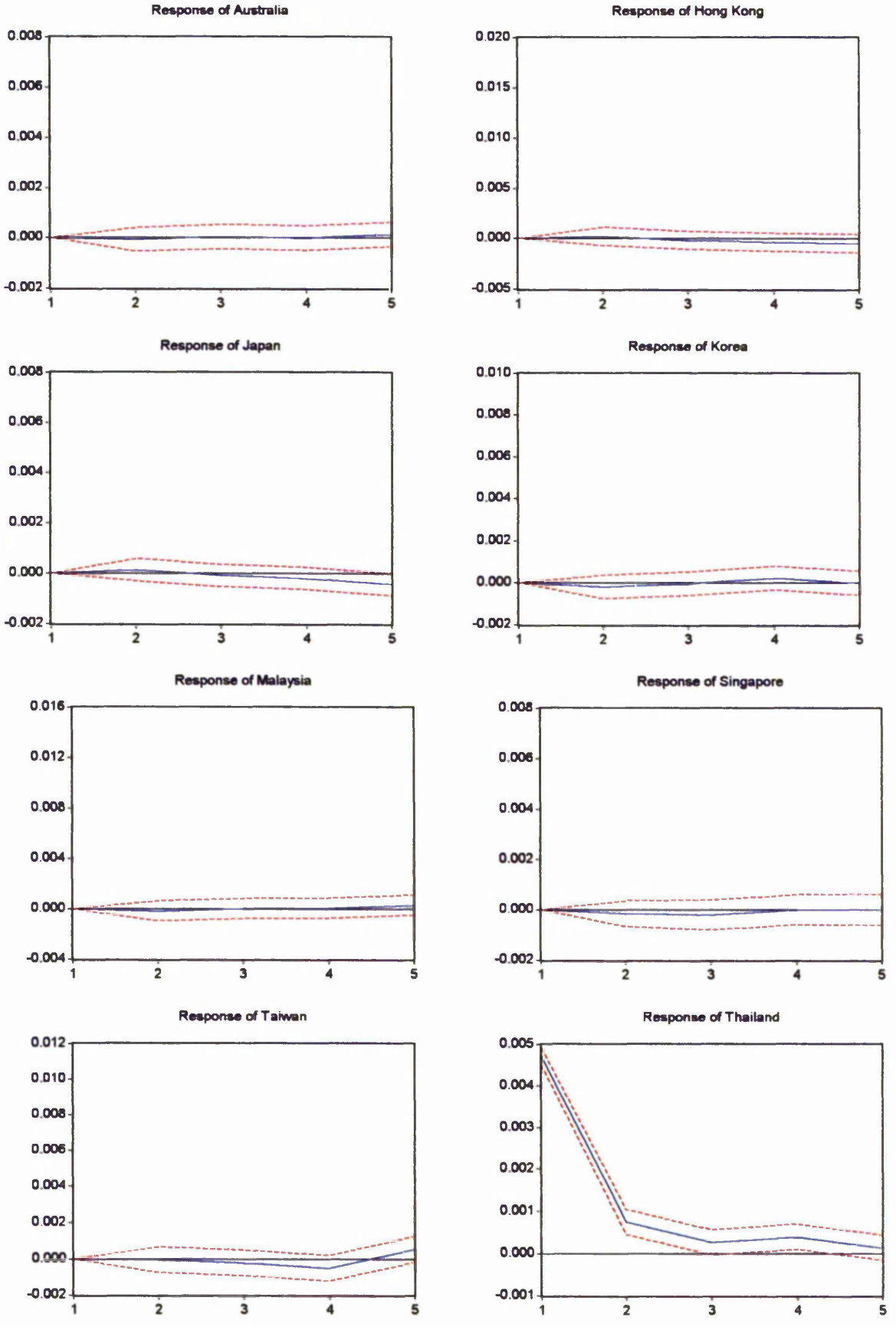
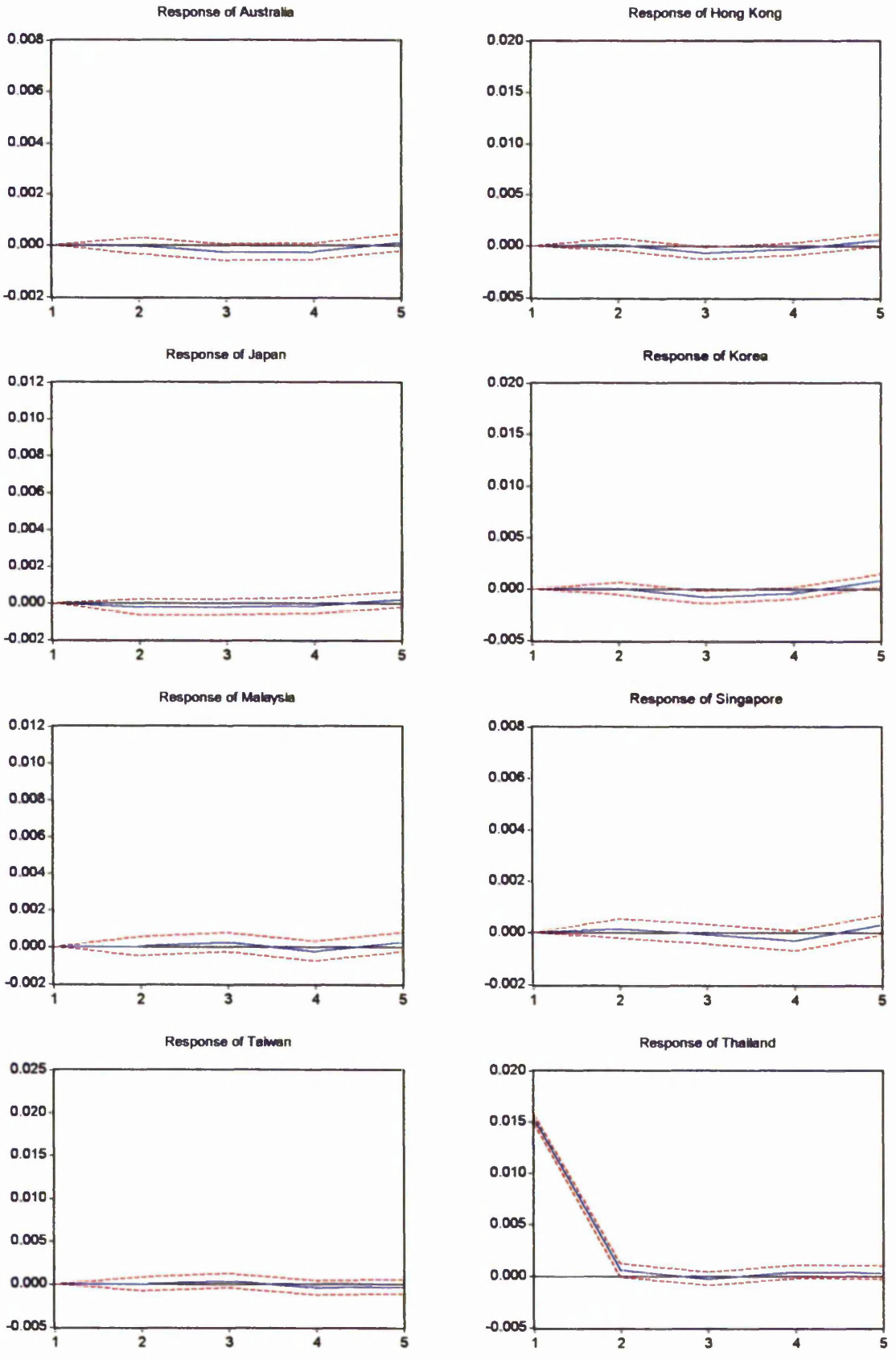


Figure 4.4.1-2h Orthogonalised Impulse Responses to Thailand One S.D. Innovations +/- 2 S.E. (Sub-period 2)



4.4.2 Othogonalized Variance Decomposition (OVDC)

The individual graphs of Variance Decompositions (ODVCs), which show the proportion of the movements in a sequence due to its "own" shocks versus shocks to the other markets, are reported in Figure 4.4.1-1a to 1h for sub-period 1 and Figure 4.4.1-2 a to 2h for sub-period 2. In addition, the Variance Decompositions results, which provide the decomposition of 5-day, 10-day, and 20-day ahead forecasts of stock market returns into fractions that are accounted for by innovations in different markets, are presented in Table 4.4.2-1 and Table 4.4.2-2 for both sub-periods, respectively.

The results from Variance Decompositions (OVDCs) in Figure 4.4.1-1c, 1d and 1g and Figure 4.4.1-2c, 2d and 2g suggest that variances in Japan, Korea and Taiwan are mostly due to their own innovations for both sub-periods. As in Table 4.4.2-1 and –2, these markets yield high percentage VDCs throughout the lag periods of their own innovations in both sub-periods. For example, this is found in the 5-days ahead analysis for Japan (98.55), Korea (96.90), and Taiwan (98.63) for the first sub-period; and Japan (98.79), Korea (95.66), Taiwan (94.42) for the second sub-period.

On the other hand, Figure 4.4.1-1a, 1b, 1e and 1f show that the variances in Australia, Hong Kong, Malaysia, Singapore and Thailand for the first sub-period have been influenced mostly by their own innovations while Figure 4.4.1-2a, 2b 2e and 2f shows that the variance in these countries for the second sub-period have been influenced not only by their own innovations but also by other markets. Indeed, as in

Table 4.4.2-1 and –2, the variance in Australia, Hong Kong, Malaysia, Singapore and Thailand have been influenced by other markets especially by Hong Kong, Japan and Malaysia. More interestingly, the average contribution of Hong Kong, Japan and Malaysia to variations in other countries are 1.92, 1.37, and 5.55 for first sub-period; 7.54, 5.46, and 3.79 for second sub-period, respectively.[189]

In addition, the variance of Singapore in the second sub-period reflects less influence from its own innovations (47.36) when compared with other markets in the region. Hence, the variance of Singapore is 'equally' attributed to innovations in Hong Kong (19.36) and Malaysia (19.24).

The overall results indicate that variance in Asia-Pacific stock markets are mostly due to their own innovations for the first sub-period. Yet, as shown in the second sub-period, no stock market is completely autonomous in that a market's own innovations 'fully' account for their variance. It is also noteworthy that a substantial increase in the degree of interaction is detected among Australia, Malaysia, Singapore and Thailand after financial deregulation. Hence, this may also suggest that financial liberalization has enhanced the inter-relationships among Asia-Pacific stock markets, and high capital controls account for instances of low interactions and vice versa.

[189] The higher rate of average contribution in Malaysia (5.55) than other two countries in first sub-period may be due to the fact that Malaysia is run under a different model with a shorter period starting 03 January1983 and ending 31 December 1986.

The results, which also confirmed the finding in the IRFs, indicate that Hong Kong and Japan are the most influential markets in the region. Japan's innovations account for about 98 percent of its own variance in both sub-periods. While no single foreign market can explain more than 0.5 percent of the variance in Japan, Japan explained the variance of other markets in the region at the average of 5.46 percent.[190]

[190] The average value for Japan, 5.46 percent, is compared with 7.54 percent for Hong Kong, another relatively influential stock market in the region with a slightly lower amount of its own variance accounted for by its own innovations (97.56 percent and 91.14 percent in the first and second sub-period, respectively) than Japan (98 percent for both sub-periods) in the second sub-period.

Figure 4.4.2-1a Variance Decomposition of Australia (Sub-period 1)

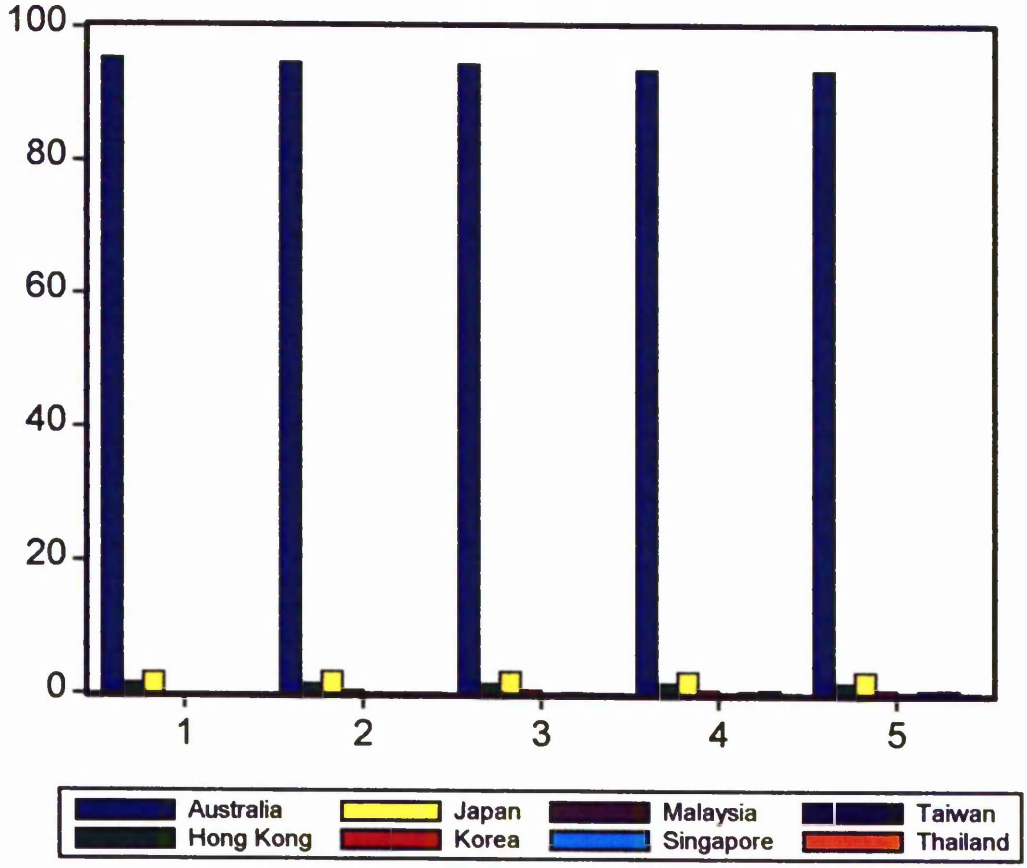


Figure 4.4.2-2a Variance Decomposition of Australia (Sub-period 2)

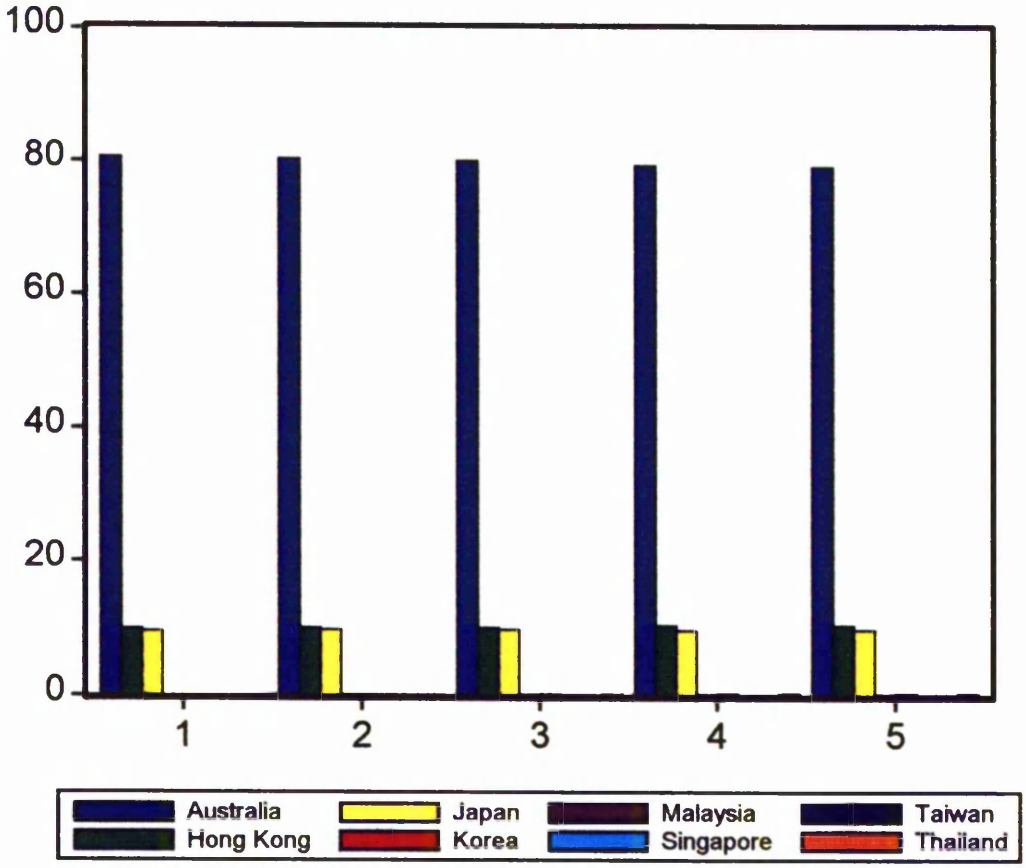


Figure 4.4.2-1b Variance Decomposition of Hong Kong (Sub-period 1)

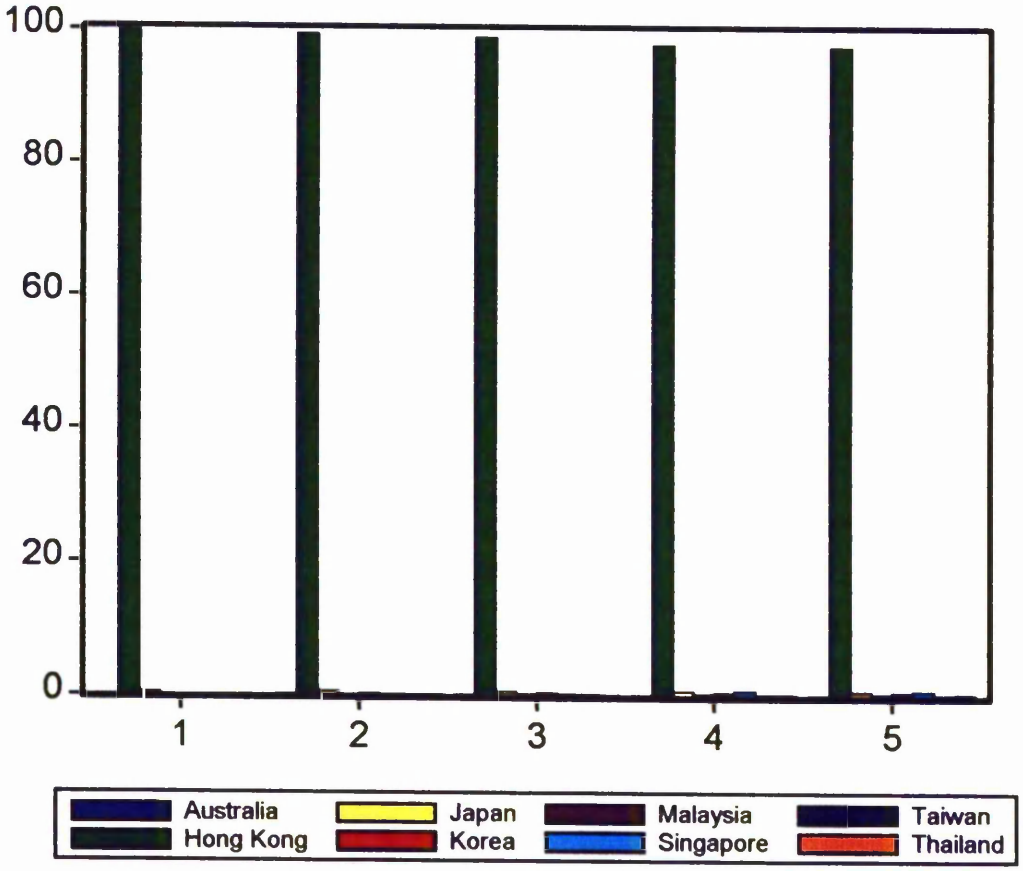


Figure 4.4.2-2b Variance Decomposition of Hong Kong (Sub-period 2)

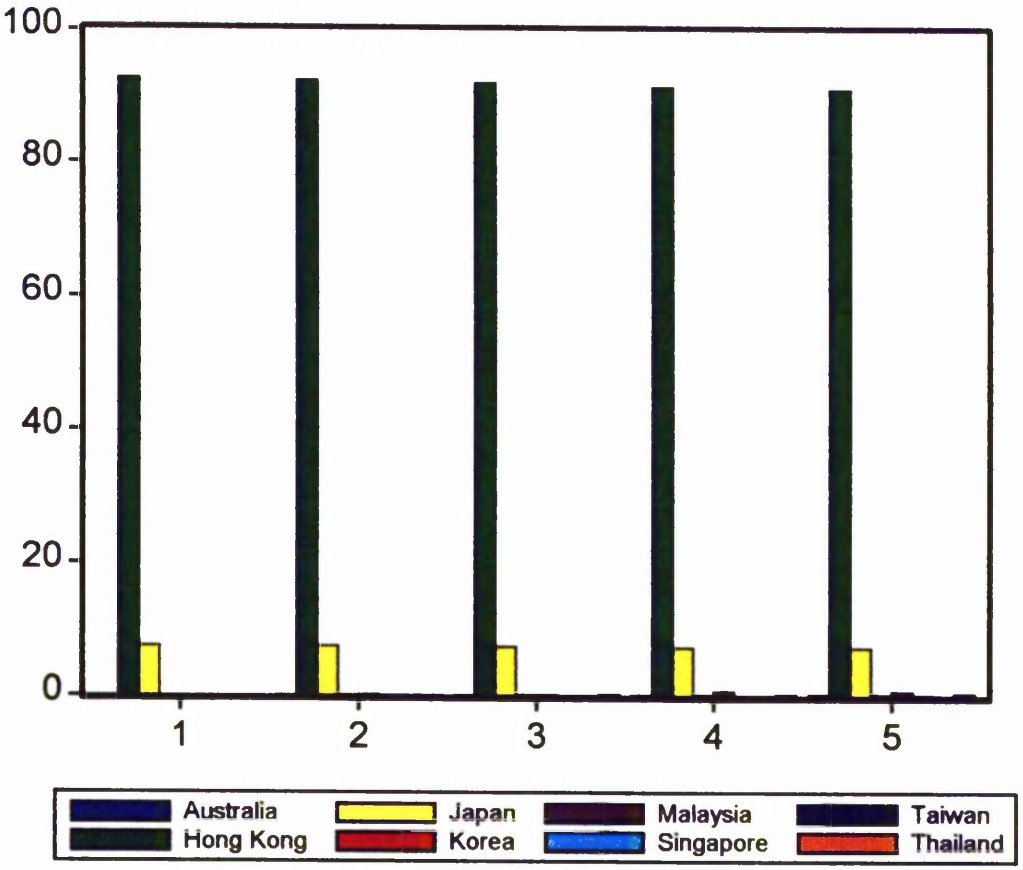


Figure 4.4.2-1c Variance Decomposition of Japan (Sub-period 1)

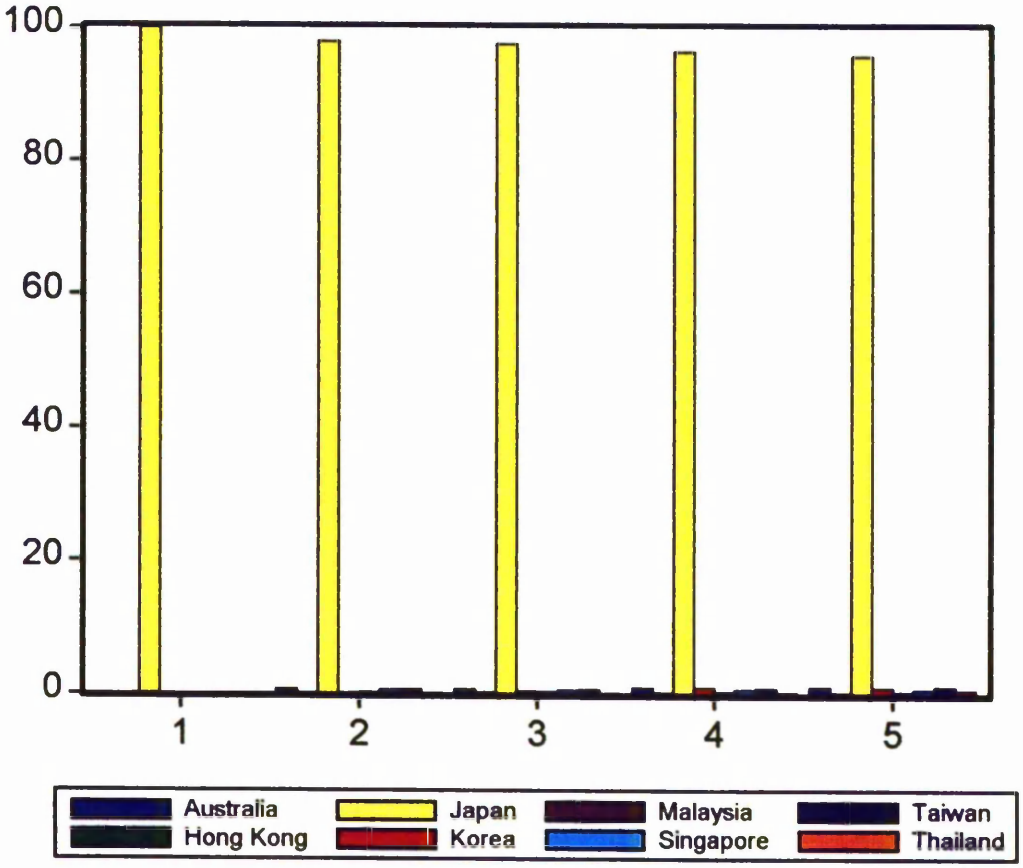


Figure 4.4.2-2c Variance Decomposition of Japan (Sub-period 2)

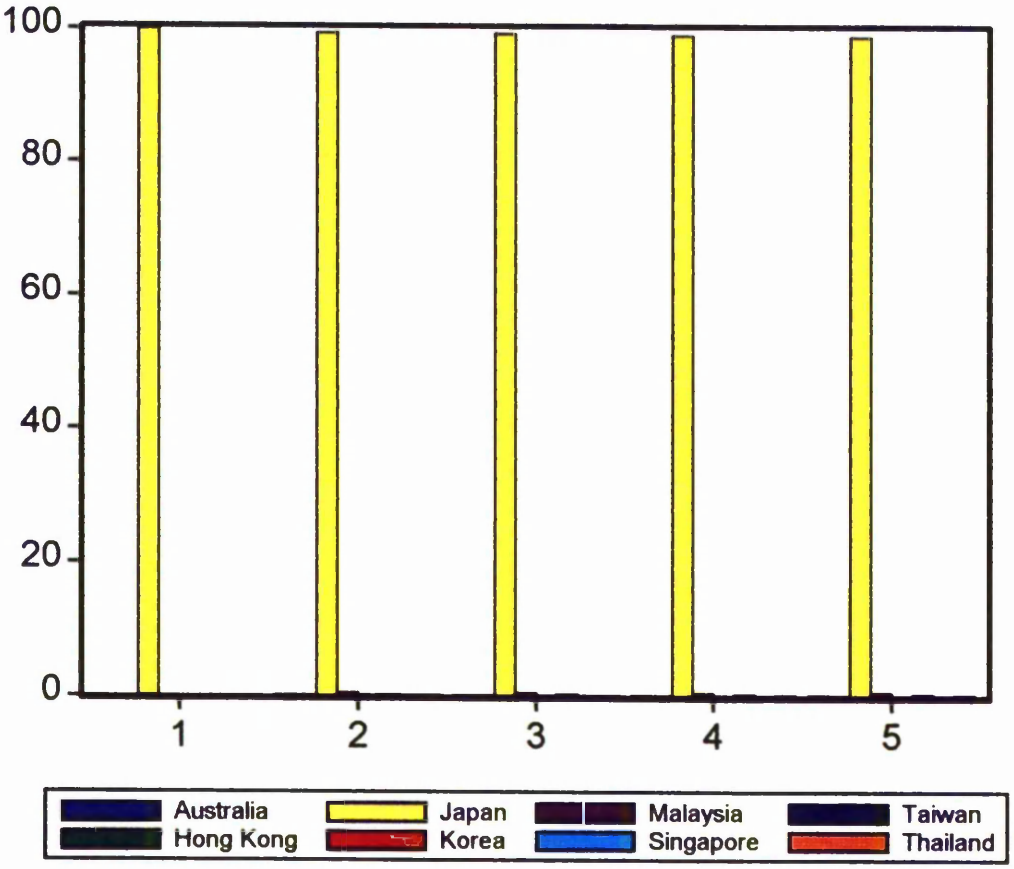


Figure 4.4.2-1d Variance Decomposition of Korea (Sub-period 1)

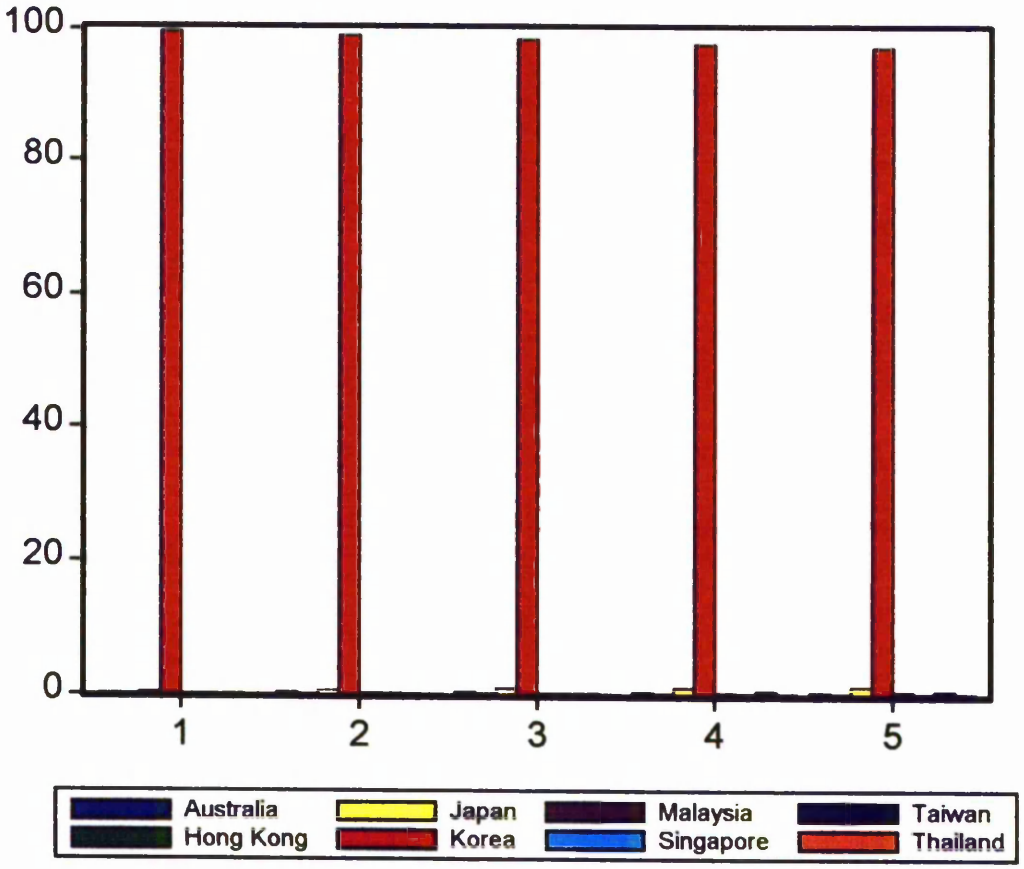


Figure 4.4.2-2d Variance Decomposition of Korea (Sub-period 2)

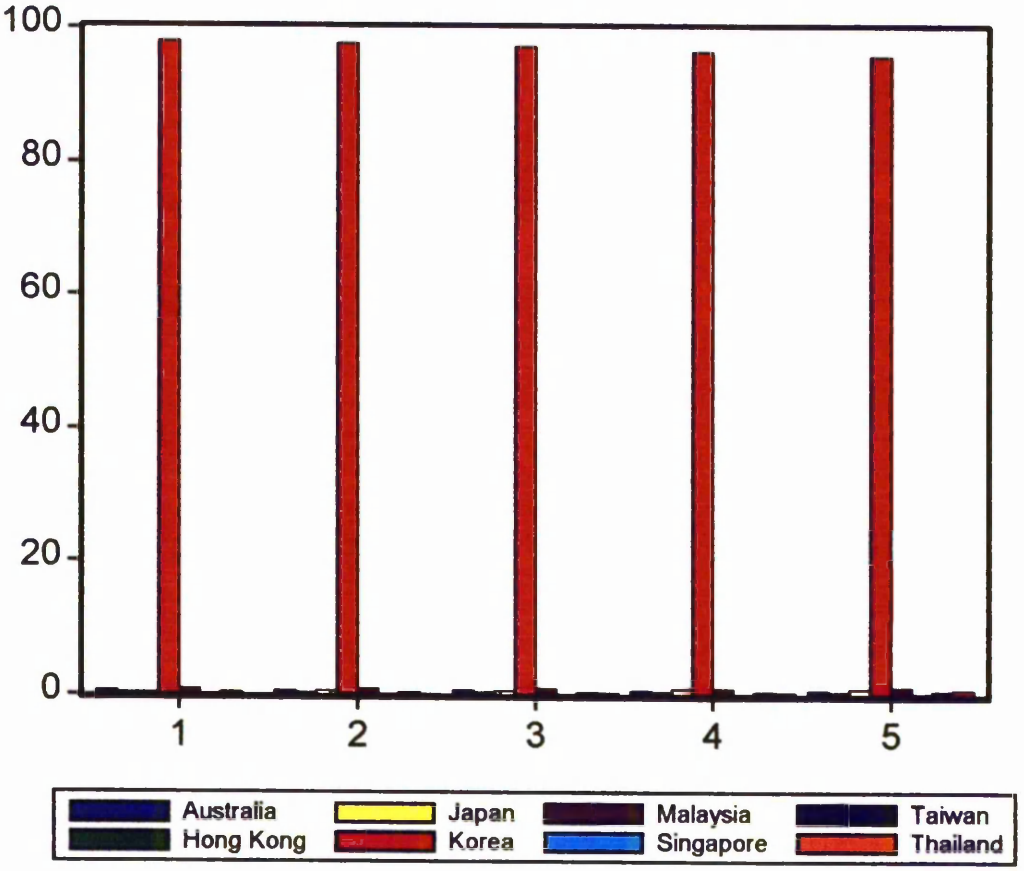


Figure 4.4.2-1e Variance Decomposition of Malaysia (Sub-period 1)

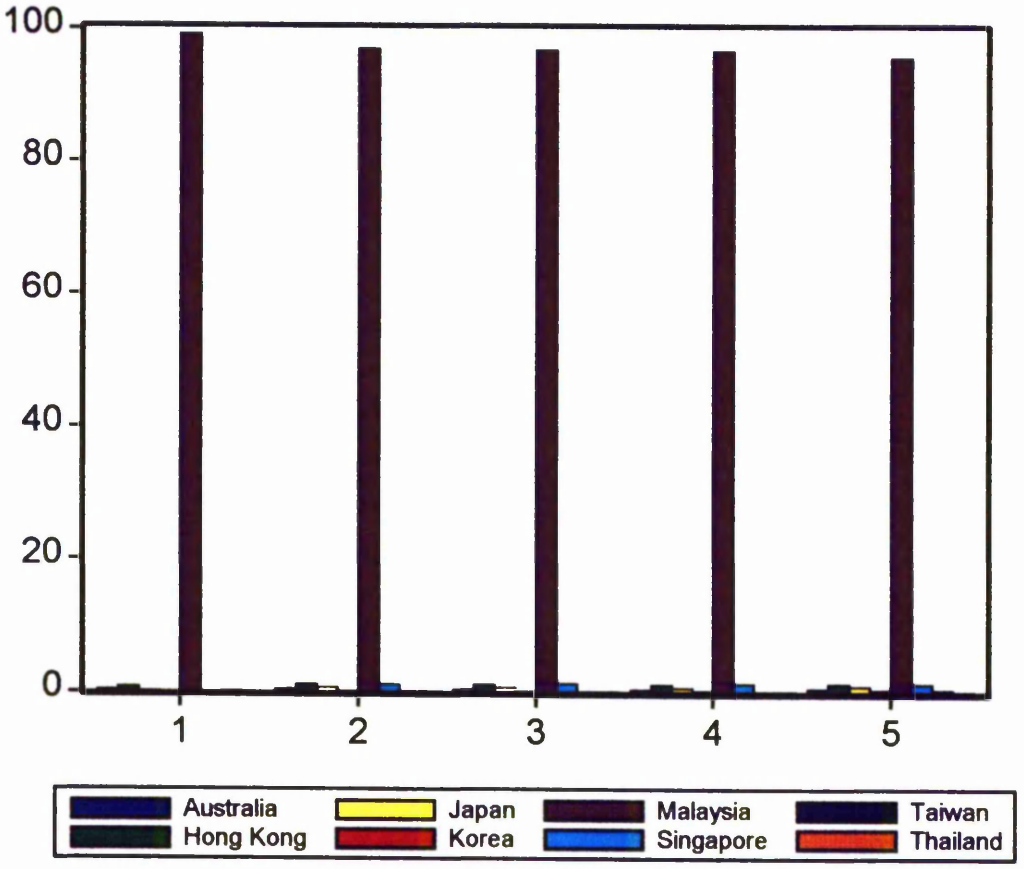


Figure 4.4.2-2e Variance Decomposition of Malaysia (Sub-period 2)

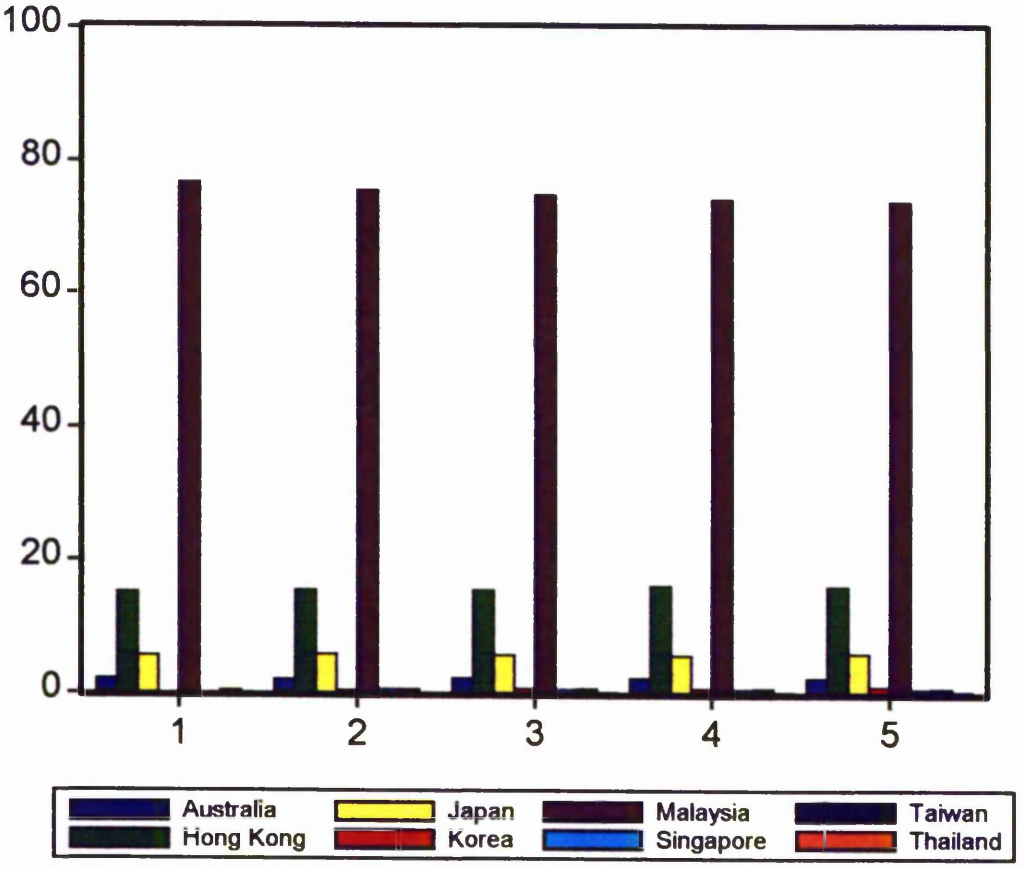


Figure 4.4.2-1f Variance Decomposition of Singapore (Sub-period 1)

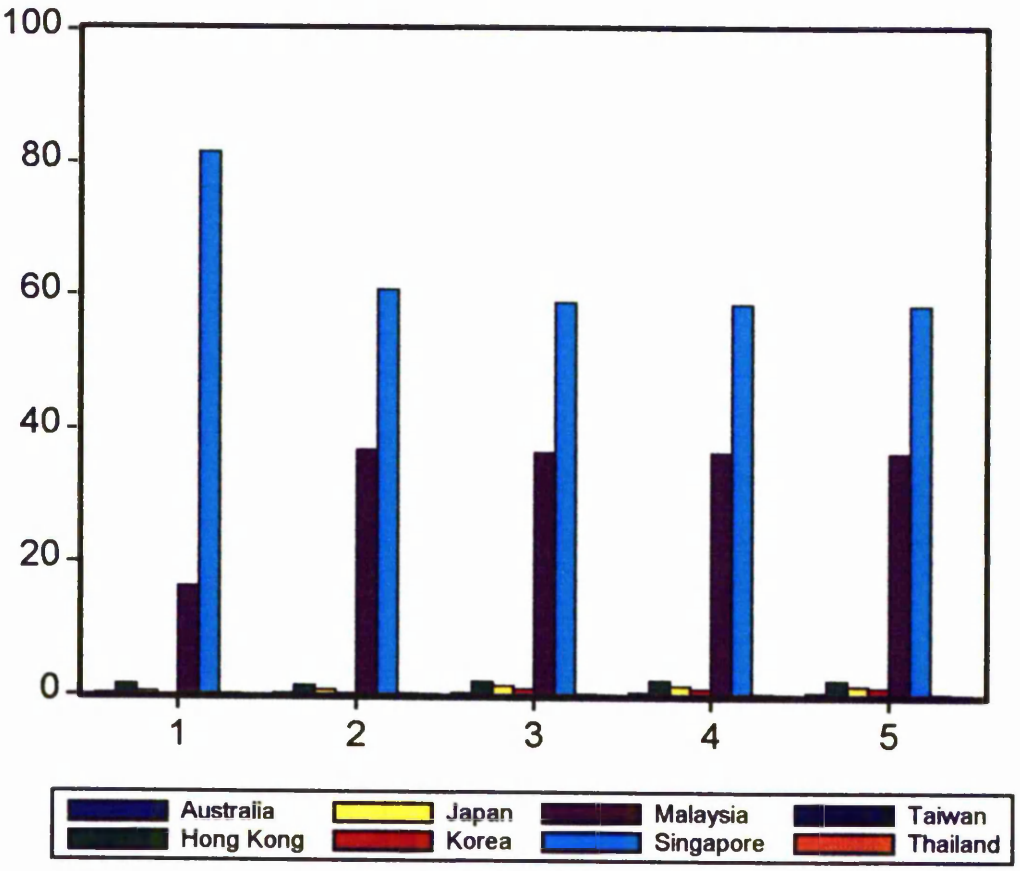


Figure 4.4.2-2f Variance Decomposition of Singapore (Sub-period 2)

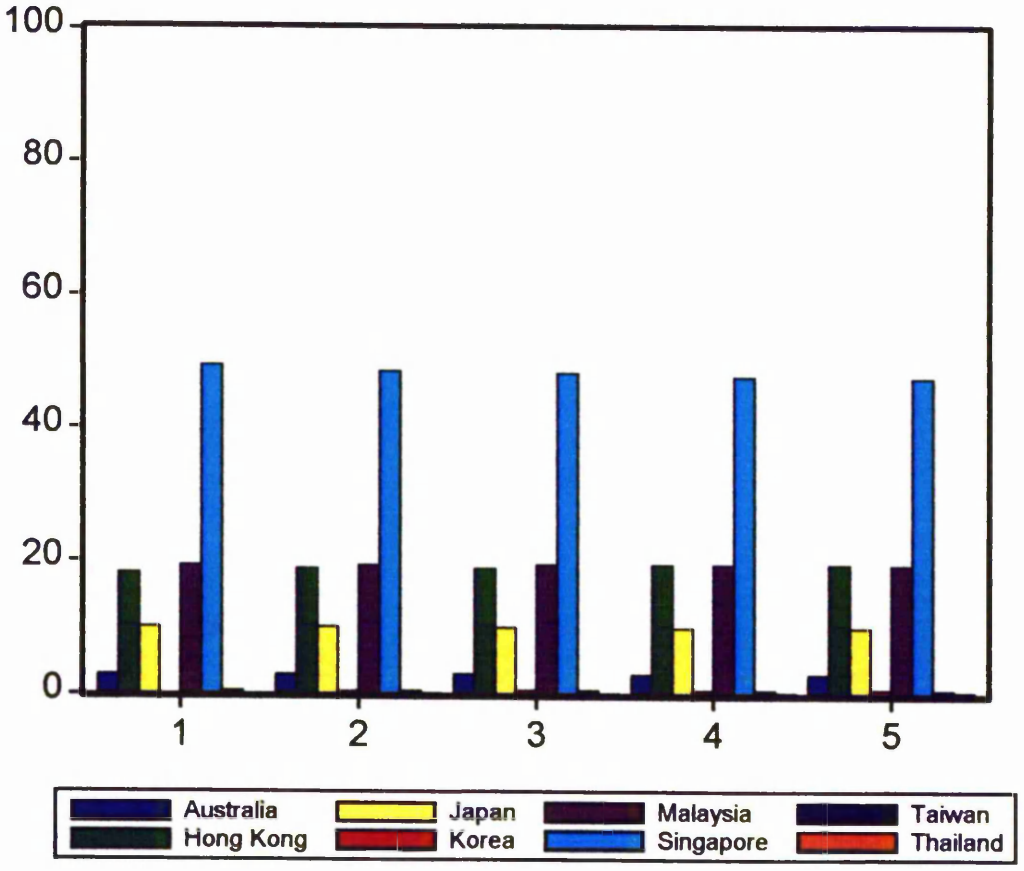


Figure 4.4.2-1g Variance Decomposition of Taiwan (Sub-period 1)

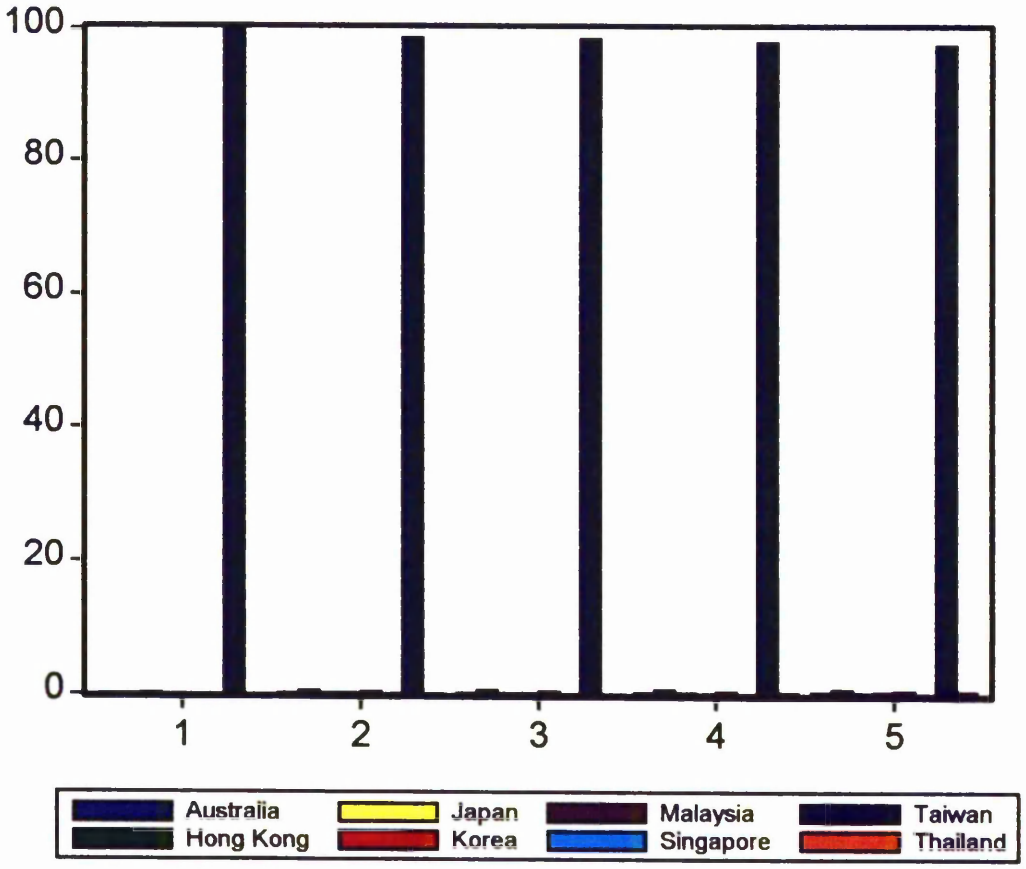


Figure 4.4.2-2g Variance Decomposition of Taiwan (SUb-period 2)

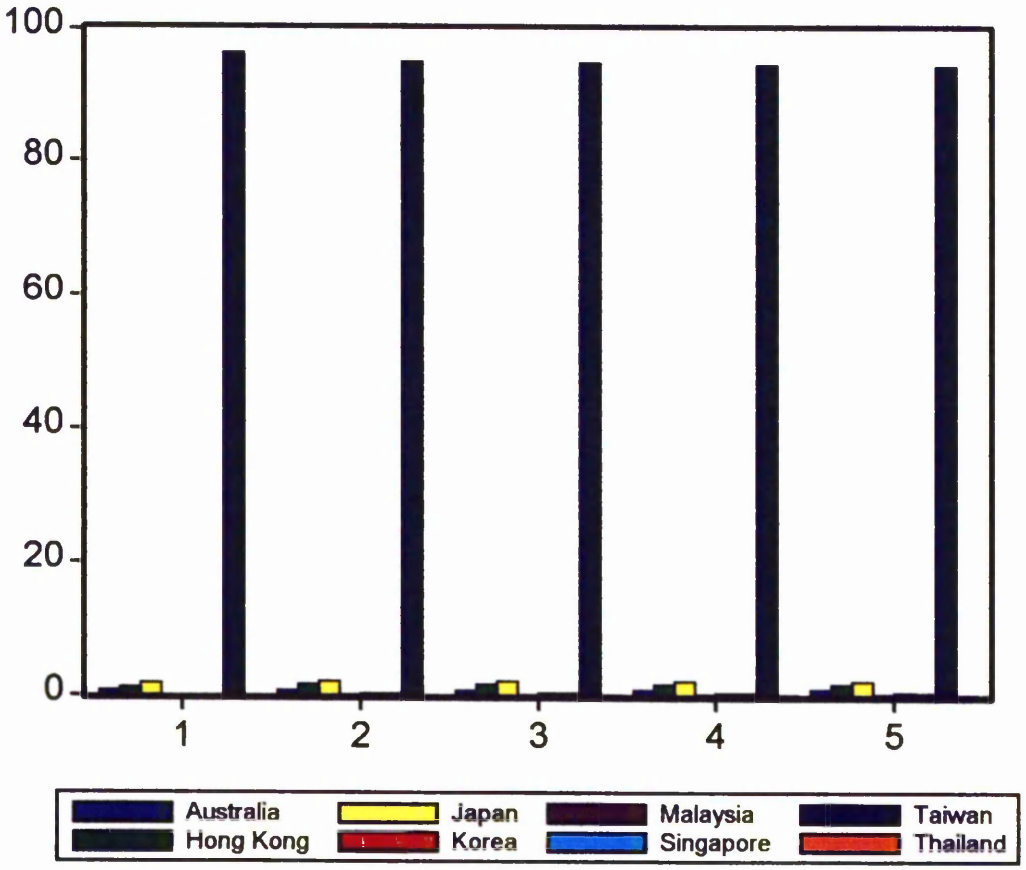


Figure 4.4.2-1h Variance Decomposition of Thailand (SUb-period 1)

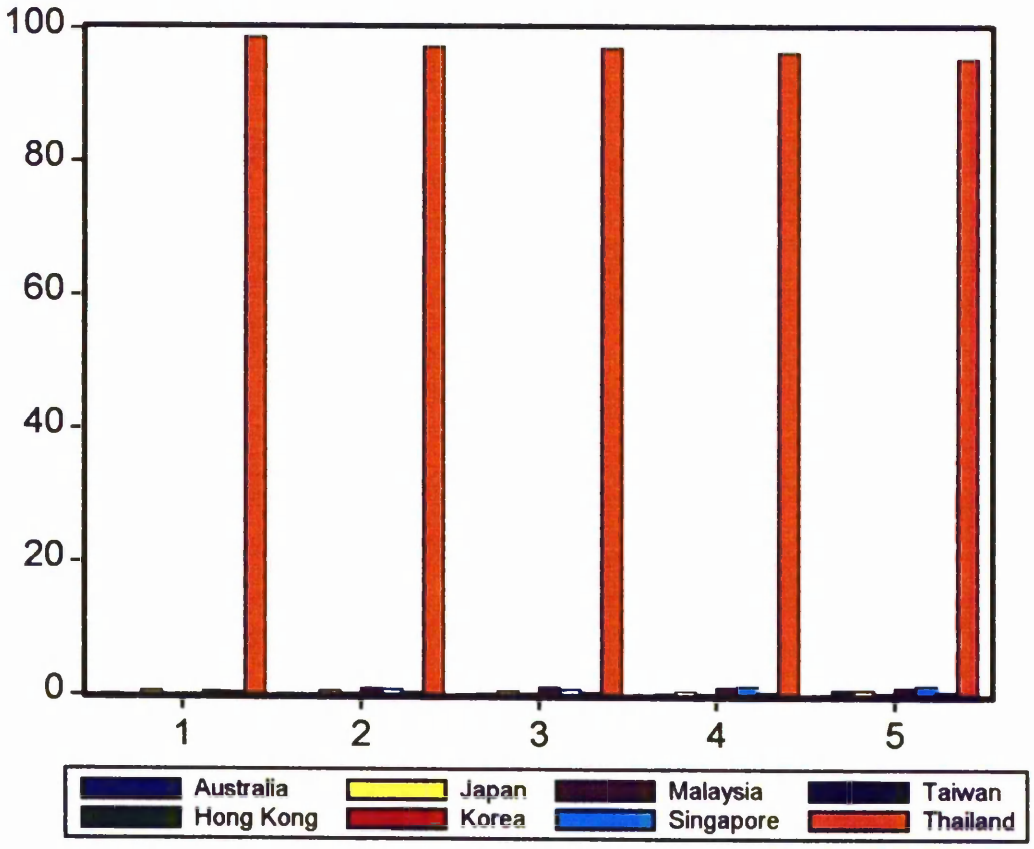


Figure 4.4.2-2h Variance Decomposition of Thailand (SUb-period 2)

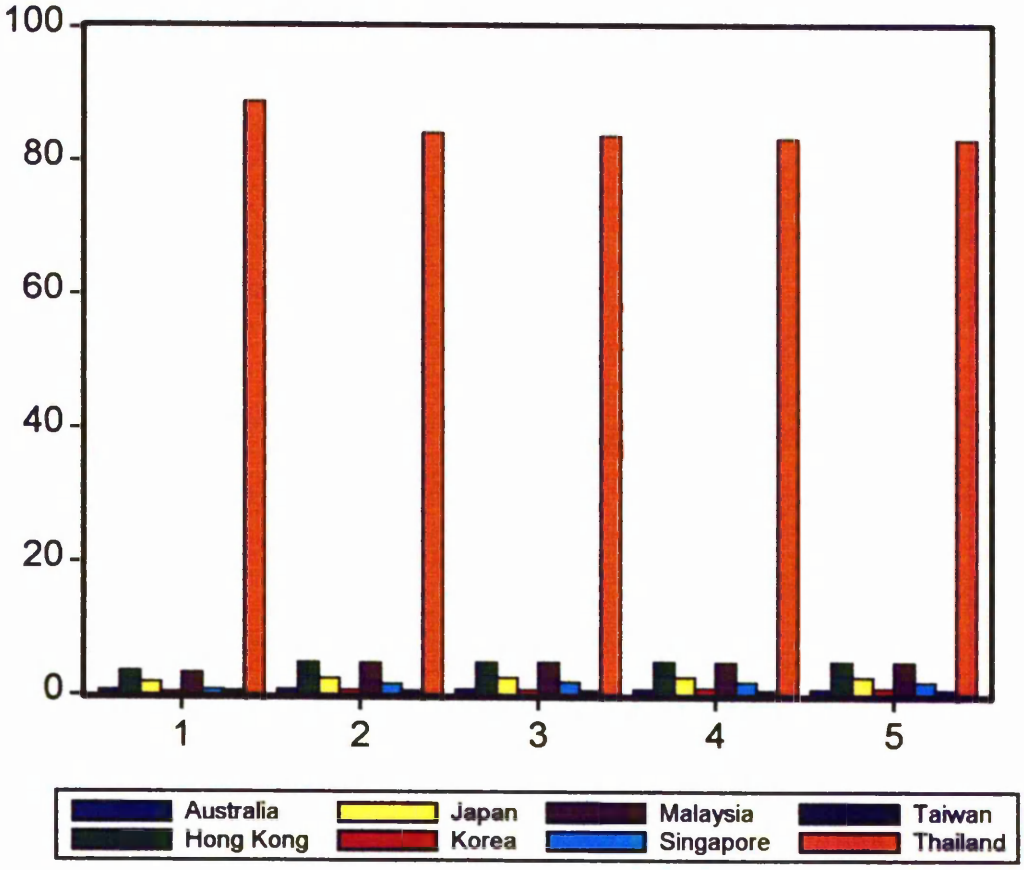


Table 4.4.2-1 Variance Decompositions; Sub-period 1: 03/ 01/ 1977 - 30/ 12/ 1998

Relative		Explained by Innovations in							
Variation in	days	**Australia**	**Hong Kong**	**Japan**	**Korea**	**Malaysia**	**Singapore**	**Taiwan**	**Thailand**
Australia	**5**	92.70	2.41	3.43	0.34	0.16	0.15	0.69	0.24
	10	92.55	2.42	3.46	0.38	0.19	0.21	0.71	0.25
	20	92.54	2.42	3.46	0.38	0.19	0.21	0.71	0.25
Hong Kong	**5**	0.04	97.56	1.70	0.01	0.46	0.26	0.38	0.02
	10	0.24	97.15	1.70	0.04	0.62	0.39	0.41	0.03
	20	0.25	97.16	1.70	0.04	0.63	0.39	0.41	0.03
Japan	**5**	0.32	0.42	98.55	0.07	0.21	0.15	0.26	0.19
	10	0.33	0.51	98.33	0.11	0.32	0.21	0.28	0.20
	20	0.33	0.51	98.33	0.11	0.33	0.21	0.28	0.20
Korea	**5**	0.97	0.33	1.18	96.90	0.38	0.20	0.26	0.12
	10	1.04	0.53	1.30	96.43	1.61	0.21	0.30	0.16
	20	1.04	0.53	1.30	96.43	1.61	0.21	0.30	0.16
Malaysia	**5**	0.47	1.21	0.83	0.32	95.51	1.21	0.34	0.08
	10	0.63	1.24	1.06	0.35	94.74	1.25	0.56	0.13
	20	0.63	1.24	1.06	0.35	94.73	1.25	0.56	0.14
Singapore	**5**	0.37	8.39	2.20	0.02	36.41	88.69	0.25	0.04
	10	0.48	8.41	2.20	0.06	36.06	88.18	0.60	0.04
	20	0.48	8.41	2.20	0.06	36.05	88.18	0.61	0.04
Taiwan	**5**	0.13	0.28	0.14	0.20	0.16	0.10	99.06	0.04
	10	0.14	0.42	0.23	0.25	0.73	0.22	98.64	0.07
	20	0.14	0.42	0.23	0.25	0.73	0.22	98.63	0.07
Thailand	**5**	0.24	0.43	0.10	0.18	1.09	0.22	0.22	98.63
	10	0.30	0.44	0.11	0.20	1.52	0.22	0.28	98.42
	20	0.31	0.44	0.11	0.20	1.56	0.22	0.28	98.42

Table 4.4.2-2 Variance Decompositions; Sub-period 2: 03/ 01/ 1988 - 30/ 01/ 1998

Relative		Explained by Innovations in							
Variation in	days	**Australia**	**Hong Kong**	**Japan**	**Korea**	**Malaysia**	**Singapore**	**Taiwan**	**Thailand**
Australia	**5**	79.23	10.35	9.65	0.17	0.25	0.09	0.05	0.22
	10	79.03	10.44	9.64	0.19	0.27	0.10	0.08	0.23
	20	79.03	10.44	9.64	0.20	0.27	0.10	0.09	0.24
Hong Kong	**5**	0.22	91.14	7.18	0.21	0.65	0.12	0.06	0.38
	10	0.23	90.98	7.14	0.29	0.67	0.14	0.13	0.39
	20	0.23	90.98	7.14	0.29	0.67	0.14	0.13	0.38
Japan	**5**	0.16	0.03	98.79	0.49	0.03	0.25	0.08	0.13
	10	0.17	0.04	98.72	0.50	0.04	0.27	0.10	0.14
	20	0.17	0.05	98.72	0.50	0.04	0.27	0.10	0.14
Korea	**5**	0.60	0.43	0.91	95.66	1.10	0.09	0.54	0.66
	10	0.66	0.71	0.90	94.49	1.23	0.39	0.59	0.99
	20	0.66	0.72	0.90	94.48	1.23	0.39	0.59	0.99
Malaysia	**5**	2.17	16.03	5.87	0.86	73.89	0.48	0.58	0.09
	10	2.17	16.21	5.88	0.94	73.31	0.48	0.81	0.19
	20	2.17	16.21	5.88	0.94	73.30	0.49	0.80	0.19
Singapore	**5**	2.86	19.36	9.87	0.59	19.24	47.36	0.47	0.22
	10	2.85	19.41	9.84	0.61	19.19	47.16	0.66	0.25
	20	2.85	19.41	9.84	0.61	19.19	47.15	0.66	0.25
Taiwan	**5**	0.84	1.66	2.12	0.12	0.40	0.34	94.42	0.08
	10	0.83	1.65	2.13	0.19	0.43	0.36	94.25	0.10
	20	0.84	1.65	2.13	0.19	0.43	0.36	94.25	0.10
Thailand	**5**	0.78	4.97	2.62	0.96	4.87	1.91	0.68	83.18
	10	0.80	4.98	2.61	1.06	4.87	1.92	0.83	82.90
	20	0.80	4.99	2.61	1.05	4.87	1.93	0.83	82.90

4.5 Conclusion

This chapter has applied Impulse Response Functions (IRFs) and Variance Decompositions (VDCs) techniques in a VAR model to examine the issue of inter-relationships among eight Asian-Pacific stock markets before and after major international as well as national events. First of all, the evidence shows that most of the responses to a shock are completed within two days in both sub-periods, indicating stock markets adjust quickly to all relevant information.

It is also important to note that most of the stock markets in the region are found to be quite highly influenced by their own markets in both sub-periods (especially Japan, Korea and Taiwan), with the exception of Singapore in the second period (See figure 4.4.2-1f and –2f).

This study also indicates that Japan and Hong Kong are the most influential in the region as the results show that other markets in the region tend to be quite sensitive in response to a shock or innovation in Japan and in Hong Kong for both periods. On the other hand, Malaysia turns out to be the most interactive market. Malaysia has a high rate of response to all shocks from other markets, especially for the second sub-period.

Moreover, this study finds a substantial increase in the degree of interdependence after the 1987 crash, and hence, reflects the effect of financial deregulation in the region. The results also indicate that a significant link exists only between markets with less (or no) restrictions on foreign investment, such as Australia,

Hong Kong, Singapore and Malaysia. On the other hand, Taiwan and Korea are not very responsive to innovations on other markets since the restrictions on foreign investment in these two markets are quite severe.

Chapter 5 Stock Markets and Macroeconomic Fundamentals: A Causal Analysis

5.1 Introduction

This chapter is the second in a two-part analysis of Asia-Pacific stock markets. The first part (chapters 3 and 4) examined the inter-relationships among stock markets in the region and discussed the impact of foreign stock markets on domestic ones. That part ended with the overall conclusion that financial liberalization has enhanced market integration in the region. However, while the results indicate the increasing inter-relationships among Asia-Pacific stock markets as a whole, rather weak inter-relationships have continued to exist especially for those countries with high capital controls. In the light of these findings, this chapter, the second part of examining the behavior of stock prices, looks at the impact of domestic fundamentals on stock returns.[190]

The main purpose of this chapter, therefore, is to investigate the existence of any interaction between stock returns and macroeconomic fundamentals in Asia-Pacific countries. The methodology used in the chapter is based on Granger Causality analysis. This test is related to the idea of the impact of historical information about one variable

[190] The studies on the relationship of a stock market to macroeconomic fundamentals in the US have been well documented, and the general consensus is that stock prices in the US response in anticipation of change in future economic activities.

on another variable. Thus, it focuses on the predictive content of historical information of stock returns in explaining macroeconomic variables and it also allows one to examine the historical feedback effect of these macroeconomic variables on the stock markets.

The results from the similar studies[191] in the Asia-Pacific region have not been conclusive. However, one counter-argument is that the stock markets in the Asia-Pacific region are much smaller in size as compared to those in developed markets (such as the US), hence, they may be more vulnerable to speculative bubbles [192] and fads. If so, then this study is likely to find that stock markets in Asia-Pacific countries may not be tied to fundamentals. Hence, it is the intent of this study to shed light on this issue.

The organization of this chapter is as follows. Section 5.2 contains a description of the data while Section 5.3 describes the Granger Causality methodology. The empirical results are reported in section 5.4 and the last section, 5.5, offers a summary and concluding remarks.

[191] Such as Fung and Lie (1990), Cheong (1992), etc. For further detail see chapter 2.

[192] The term "speculative bubble" is used to describe "an episode in which the stock price displays an explosive divergence from its fundamental value." For a detailed discussion on asset price bubbles, see Gilles (1989), Gilles and LeRoy (1992) and West (1987).

5.2 Data

The overall data sets used in this study cover the period from January 1973 to January 1998. The data are divided into three sample periods: (1) the whole sample period set: January 1973 - January 1998; (2) sub-period: January 1988 - January 1998; (3) sub-period: January 1973 - December 1987. The reason for dividing the sample into sub-periods is to investigate the effect of financial liberalization and to reflect the finding in Chapter 1 that the most significant liberalization occurred after 1987 in the Asia-Pacific region.

The data for this study consist of monthly, quarterly, and annual stock market indices and macroeconomic variables -- indices of money supply, consumer price index (CPI), exchange rates, call money rate, yield on government bonds, corporate bond rate, industrial production, trade balance, gross national product, and private consumption. They cover eight Asia-Pacific countries, namely Australia, Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand.

Nearly all the data in this study are taken from Datastream. Since the data for the macroeconomic variables in the eight Asia-Pacific countries are available in different frequencies and with different starting and ending dates, the first column in each of the tables from 5.4-1 to 5.4-8 provides a description of each macroeconomic variable in terms of frequency.

5.3 Methodology

This section is divided into two parts. Section 5.3.1 discusses the likely candidates for macroeconomic variables in terms of their returns to the theoretical model of pricing, the dividend discount model.[193] In section 5.3.2, the Granger Causality test is reviewed for the purpose of examining the "causal" relationship between stock returns and macroeconomic variables.

5.3.1 Macroeconomic Variables

Chen *et al.* (1986), using the dividend discount model, specified a number of variables that would appear likely as potential factors affecting stock returns. The dividend discount model derives the price of stock j as:

$$P_j = E(C_j) / k \qquad [5.3.1\text{-}1]$$

Where

Pj: stock price

Cj: dividend stream

k: discount rate

From this dividend discount model, the factors that influence stock returns are specified as those that could affect the discount rate, k, and the expected cash flows, E(Cj).

[193] See Chen et al (1986)

Note that this study assumes that the index reflects a similar relationship at the aggregate level. Therefore, Chen *et al* (1986) proposed a set of relevant variables which systematically affect stock market returns: changes in the risk premium (the difference between long-term government and corporate bond yields); changes in the term structure (the difference between long-term and short-term government bond yields); changes in industrial production; and changes in inflation.

In addition to the above variables, we may also consider other monetary variables and measures of a country's economic performance, namely the money supply, the exchange rate, gross national product, the trade balance and private consumption. It is of interest to include these variables as several other studies, which have linked the stock market to macroeconomic variables, have found that stock returns may respond to these monetary variables[194] and may reflect forecasts of future output. [195] One explanation is that forecasts of higher economic activities should make stocks more attractive and thus cause an increase in prices.

---

[194] See Berkman (1978), Lynge (1981), Cornell (1983), Pearce and Roley (1983), Cramer (1986), and Friedman (1988). For example, Cornell (1983) found that stock prices respond negatively to the money supply.

[195] See Fama (1981), Fama and Gibbons (1982), Huang and Kracaw (1984), and Harris and Opler (1990) which indicate that there is a strong positive relationship between the stock market and economic activities in terms of gross national product, and the trade balance, among others.

5.3.2 Granger Causality Test

To understand how macroeconomic variables interact with the stock market, this study tests whether macroeconomic variables in each of the eight Asia-Pacific countries Granger-causes its stock returns, or vice versa. Using the method of Granger (1969) involves estimating the following regression:

$$Yt = a + bi\ Y(t\text{-}i) + ci\ X(t\text{-}i) + ut \qquad [5.3.2\text{-}1]$$

$$Xt = a' + b'i\ X(t\text{-}i) + c'i\ Y(t\text{-}i) + u't \qquad [5.3.2\text{-}2]$$

Where

a and a':	constants
u and u':	random disturbance
Yt:	stock return series
Xt:	macroeconomic variable series

The Granger Causality test consists of running regressions of stock returns on itself lagged and on each lagged economic variable.[196] Hence, if the lagged values of economic variables do not contribute a statistically significant explanation then economic variables do not Granger-cause stock returns. Similarly, to examine whether stock returns Granger-cause economic variables, the regression of each economic variable on itself lagged and the lagged stock returns is run and the contribution of the lagged stock return is examined.

---

[196] Using the residuals from both regression, the hypothesis that all coefficients are zero, $b1 = ... bi = 0$; and $c1 = ... ci = 0$, can be tested.

Note that estimating Granger Causality equations requires prior tests of stationarity on all series and specification of the number of lags. In this study, both ADF and Phillips-Perron tests are used to check the stationarity of the series. [197] The lag length is determined by checking both the Akaike and the Schwartz criteria. [198] The null hypotheses being tested are that the joint significance of all *ci* is zero if each economic variable does not Granger-cause stock returns; and that the joint significance of c'i is zero if stock returns do not Granger-cause each economic variables. Hence, the test is the standard F-test.

However, it is important to note that the test for Granger-Causality is more a temporal ordering and a predictive ability rather than 'causality' as that word is commonly understood. Hence, the meaning of 'causal' in this study should understood as 'preceding'. Another criticism is that the Granger-causality test is based on linear forecasting models. If the actual economic model is nonlinear, Granger-causality tests will be based on false forecasts and provide ambiguous results. In spite of its limitations, the Granger Causality test is an appropriate technique for the purpose of this study which is concerned primarily with whether a change in stock returns appears to be correlated with macroeconomic fundamentals and vice versa.[199]

---

[197] All series in this study are found to be stationary in first difference, with the exception of annual series which are stationary in second difference.

[198] The results are robust regardless of the order of lags.

[199] Due to the limitations of the data series, such as different frequencies and sample periods, another reason for using the Granger Causality test rather than other methods is that the Granger Causality analysis offers pairwise tests.

5.4 Empirical Results

The results of pairwise Granger Causality tests are reported in Tables 5.4-1 to -8. Each table contains three sample periods: (1) the whole sample period: January 1973 - January 1998; (2) the sub-period: January 1988 - January 1998; and (3) the sub-period: January 1973 - December 1987. The economic variables used are: money supply, inflation, exchange rate, call money rate, yield on government bonds, corporate bond rate, term structure, default risk premium, industrial production, trade balance, gross national product, private consumption and consumption per capita.

Each table contains the results of running regressions of pairs of stock return and each economic variable. It is important to be aware that this study uses 'cause' as a measure of precedence and information content, which does not by itself indicate causality in the more common use of the term. [200] Bearing this in mind, several interesting observations emerge from the overall analysis.

First, the findings show that the exchange rate and the corporate bond yield are the factors which 'caused' stock returns in many markets. Second, with few exceptions, stock returns are independent of inflation, money supply and the trade balance. Third, there is no support of reverse causation. No evidence of feedback 'causal' relationships between stock returns and macroeconomic fundamentals is found in any period. Fourth,

[200] That is if 'Y does not Granger "cause" X ' is strongly rejected, then Y has strong predictive power for X, and vice versa.

this study finds a reduction of the pair of the 'causal' relationship between stock returns and macroeconomic fundamentals after financial liberalization. [201]

For each country in the causal analysis, the results can also be divided into three groups:

(i) " <==> " : indicates feedback in the causal analyses which means that 'causal' relationships exist in both directions to and from stock returns;

(ii) "==> " or "<== ": show a unidirectional causality in the causal analyses which indicates 'causal' relationships in just one direction from macroeconomic variables to stock returns;

(iii) " – x –": indicates independence in the causal analyses which means no 'causal' relationship in any direction.

For the first group, the stock returns in the Asia-Pacific region uniformly have no feedback in the causal analyses neither in the whole sample period nor in pre- and post-financial liberalization sub-periods.

Most stock returns in the Asia-Pacific region fall into the second group: a unidirectional. First of all, Australia, Hong Kong, Malaysia and Thailand exhibit unidirectional causality between stock returns and a few macroeconomic fundamentals but there is no 'feedback' relationship.

---

[201] One explaination is financial liberalization leads to increased foreign capital flows, which do not respond to domestic fundamentals.

Stock returns in Australia are unidirectionally 'caused' by the exchange rate, treasury bill rate, yield of government long-term bonds, corporate bond rate and default risk premium. Stock returns unidirectionally influence its industrial production and gross national product. In Hong Kong, stock market returns are unidirectionally 'caused' by the call money rate and the exchange rate but unidirectionally influenced its private consumption. There is unidirectional causality from stock returns to the exchange rate but from industrial production to stock returns in Malaysia. These findings are consistent with several studies [202] and they may suggest that stock returns in Australia, Hong Kong and Malaysia indeed respond to monetary variables and they also reflect forecasts of future output.

On the other hand, stock returns in Thailand are unidirectionally 'caused' by the exchange rate and unidirectionally influenced its call money rate and term structure. This indicates the importance of monetary variables in the Thai market.

Secondly, stock returns in Japan, Korea and Taiwan are unidirectionally 'caused' by their macroeconomic fundamentals, but with no influence on their macroeconomic fundamentals. In Japan, stock returns have no unidirectional influence onmacroeconomic fundamentals and is only unidirectionally 'caused' by the yield on government long-term bonds and the corporate bond rate. In Korea there is only unidirectional causality from the exchange rate, call money rate, corporate bond rate and the term structure to stock

[202] See section 5.3.1.

returns. In Taiwan, stock returns are unidirectionally 'caused' by the money supply, exchange rate, yield of government long-term bonds, corporate bond rate, default risk premium and trade balance ratio. These findings may suggest that stock returns in Japan, Korea and Taiwan only respond to monetary variables. In addition, import and export performance also influences the Taiwanese market.

The third group, as in the case of Singapore, shows that there is no 'causal' relationship between the stock market and macroeconomic variables. This may indicate that Singapore is independent of its macroeconomic variables in the causal analyses.

Table 5.4-1 Australia: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998				Period: around 1988 -- 1998				Period: around 1973 -- 1987			
Economic Variables	Regression Pair (y -x- x)	Obs	F-statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability
Money Supply	DLM -x- DLAU	251	0.50435	0.60452	DLM -x- DLAU	74	0.37339	0.68978	DLM -x- DLAU	177	1.37051	0.25674
(73:01-94:02; monthly)	DLAU -x- DLM		2.28558	0.10387	DLAU -x- DLM		1.45258	0.24103	DLAU -x- DLM		0.86981	0.42087
Inflation	DLCPI -x- DLAU	96	0.42468	0.65527	DLCPI -x- DLAU	39	2.02133	0.14809	DLCPI -x- DLAU	57	0.89869	0.41333
(73:q1-97:q3; quarterly)	DLAU -x- DLCPI		0.46344	0.63059	DLAU -x- DLCPI		0.23521	0.79168	DLAU -x- DLCPI		1.74113	0.18539
Exchange Rate	**DLEX---->DLAU**	286	3.91721*	0.02099	DLEX -x- DLAU	120	1.42845	0.24391	DLEX -x- DLAU	177	1.82664	0.16406
(73:01-97:12; monthly)	DLAU -x- DLEX		1.96816	0.14163	DLAU -x- DLEX		1.17926	0.31121	DLAU -x- DLEX		1.15115	0.31871
Treasury Bill Rate	**DLTB---->DLAU**	296	4.11395*	0.01731	DLTB -x- DLAU	119	2.73355	0.06952	DLTB -x- DLAU	177	2.51496	0.08384
(73:01-97:11; monthly)	DLAU -x- DLTB		0.37054	0.69068	DLAU -x- DLTB		1.94562	0.14761	DLAU -x- DLTB		1.07858	0.34237
G-Bond (long-term)	**DLGB---->DLAU**	297	9.79821*	0.00007	**DLGB---->DLAU**	120	11.3788*	0.00003	**DLGB---->DLAU**	177	4.03924*	0.01937
(73:01-97:12; monthly)	DLAU -x- DLGB		0.82187	0.44062	DLAU -x- DLGB		1.43746	0.24177	DLAU -x- DLGB		0.38737	0.67943
Co-Bond (low-grade)	**DLCB---->DLAU**	99	10.3131*	0.00008	**DLCB---->DLAU**	99	10.3131*	0.00008	na na	na	na	na
(89:09-98:02; monthly)	DLAU -x- DLCB		0.36735	0.69356	DLAU -x- DLCB		0.36735	0.69356	na na	na	na	na
Term Structure	TS -x- DLAU	296	0.59453	0.55249	TS -x- DLAU	119	1.80521	0.16911	TS -x- DLAU	177	0.94728	0.38981
(73:01-97:11; monthly)	DLAU -x- TS		0.16071	0.85162	DLAU -x- TS		1.59921	0.20655	DLAU -x- TS		0.64234	0.52732
Default Risk Premium	**DR ---->DLAU**	97	15.9686*	0.00001	**DR ---->DLAU**	97	15.9686*	0.00001	na na	na	na	na
(89:09-98:02; monthly)	DLAU -x- DR		0.51391	0.59987	DLAU -x- DR		0.51391	0.59987	na na	na	na	na
Industrial Production	DLIP -x- DLAU	91	0.39402	0.67555	DLIP -x- DLAU	34	0.22175	0.80246	DLIP -x- DLAU	57	0.93535	0.39895
(73:q1-96:q2; quarterly)	**DLAU ---->DLIP**		8.20311*	0.00055	DLAU -x- DLIP		3.04375	0.06311	**DLAU ---->DLIP**		6.40869*	0.00325
Trade Balance Ratio	TBR -x- DLAU	84	0.19387	0.82415	TBR -x- DLAU	27	0.08482	0.91898	TBR -x- DLAU	57	0.06157	0.94036
(73:q1-94:q3; quarterly)	DLAU -x- TBR		0.56261	0.57199	DLAU -x- TBR		1.43224	0.26018	DLAU -x- TBR		0.59605	0.55471
Trade Balance	DLTR x- DLAU	84	0.36037	0.69856	DLTR x- DLAU	27	0.01168	0.96641	DLTR x- DLAU	57	0.86768	0.42591
(73:q1-94:q3; quarterly)	DLAU -x- DLTR		1.51291	0.22658	**DLAU---->DLTR**		4.76272*	0.01912	DLAU -x- DLTR		0.05013	0.95115
Gross National Product	DLGNP-x-DLAU	95	0.87522	0.42028	DLGNP-x-DLAU	38	1.35977	0.27073	DLGNP-x-DLAU	57	0.79395	0.45746
(73:q1-97:q2; quarterly)	**DLAU-->DLGNP**		3.01652*	0.05395	DLAU-x-DLGNP		0.16897	0.84526	DLAU-x-DLGNP		2.36165	0.10431
Private Consumption	DLPC x- DLAU	20	0.43602	0.65454	DLPC x- DLAU	9	0.94545	0.46106	DLPC x- DLAU	11	0.39581	0.68951
(73 - 96; annually)	DLAU -x- DLPC		0.56537	0.57981	DLAU -x- DLPC		0.63076	0.57796	DLAU -x- DLPC		0.49334	0.63334
Consumption per capital	PCP x- DLAU	20	1.78145	0.20223	PCP x- DLAU	9	0.14941	0.86582	PCP x- DLAU	11	0.80111	0.49162
(73 - 96; annually)	DLAU -x- PCP		1.92368	0.18043	DLAU -x- PCP		1.42992	0.34001	DLAU -x- PCP		1.83002	0.23962

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-2 Hong Kong: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998				Period: around 1988 -- 1998				Period: around 1973 -- 1987			
Economic Variables	Regression Pair (y -x- x)	Obs	F-statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability
Money Supply	DLM -x- DLHK	203	2.2159	0.11175	DLM -x- DLHK	122	1.88536	0.15636	DLM -x- DLHK	81	0.89759	0.41183
(81:01-98:02; monthly)	DLHK -x- DLM		0.06868	0.93365	DLHK -x- DLM		0.26995	0.76389	DLHK -x- DLM		0.06524	0.99477
Inflation	DLCPI -x- DLHK	260	2.16154	0.11725	DLCPI -x- DLHK	119	0.14484	0.86532	DLCPI -x- DLHK	141	1.88755	0.15539
(76:01-97:11; monthly)	DLHK -x- DLCPI		1.36006	0.25851	DLHK -x- DLCPI		0.46695	0.62811	DLHK -x- DLCPI		0.76358	0.46798
Exchange Rate	DLEX -x- DLHK	237	0.00688	0.99315	**DLEX---->DLHK**	120	3.56081*	0.03159	DLEX -x- DLHK	117	0.86761	0.42276
(78:01-97:12; monthly)	**DLHK---->DLEX**		5.22704*	0.00602	DLHK -x- DLEX		0.53686	0.58604	**DLHK---->DLEX**		4.99545*	0.00835
Interest Rate(callmoney)	DLI -x- DLHK	143	0.06861	0.93373	DLI -x- DLHK	122	0.08674	0.91697	DLI -x- DLHK	21	0.36127	0.70233
(86:01-98:02; monthly)	**DLHK----> DLI**		11.3694*	0.00002	**DLHK----> DLI**		13.1694*	0.00001	**DLHK----> DLI**		4.76751*	0.02376
G-Bond (long-term)	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na
Co-Bond (low-grade)	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na
Term Structure	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na
Default Risk Premium	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na
Industrial Production	DLIP -x- DLHK	60	0.30967	0.73496	DLIP -x- DLHK	39	0.12527	0.88266	DLIP -x- DLHK	21	0.20871	0.81381
(82:q1-97:q3; quarterly)	DLHK -x- DLIP		0.24312	0.78502	DLHK -x- DLIP		0.02133	0.97891	DLHK -x- DLIP		0.64922	0.53568
Trade Balance Ratio	TBR -x- DLHK	88	2.44607	0.09286	TBR -x- DLHK	39	2.76771	0.07698	TBR -x- DLHK	49	0.073908	0.48339
(75:q1-97:q4; quarterly)	DLHK -x- TBR		0.09432	0.91009	DLHK -x- TBR		0.98591	0.38351	DLHK -x- TBR		0.01768	0.98248
Trade Balance	DLTR x- DLHK	88	0.43643	0.64787	DLTR x- DLHK	39	0.91246	0.41114	DLTR x- DLHK	49	0.23475	0.79176
(75:q1-97:q4; quarterly)	DLHK -x- DLTR		0.28423	0.75332	DLHK -x- DLTR		0.22412	0.80039	DLHK -x- DLTR		0.22791	0.79713
Gross National Product	DLGNP-x-DLHK	96	0.27886	0.75729	DLGNP-x-DLHK	39	0.29818	0.74409	DLGNP-x-DLHK	57	0.15493	0.85687
(73:q1-97:q3; quarterly)	DLHK-x-DLGNP		1.28579	0.28141	DLHK-x-DLGNP		0.18215	0.83429	DLHK-x-DLGNP		1.85794	0.16621
Private Consumption	DLPC -x- DLHK	96	0.59597	0.55316	DLPC x- DLHK	39	0.51687	0.60101	DLPC -x- DLHK	57	0.28309	0.75461
(73:q1-97:q3; quarterly)	**DLHK---->DLPC**		3.85401*	0.02474	DLHK -x- DLPC		0.73446	0.48722	**DLHK---->DLPC**		4.71729*	0.01311
Consumption per capital	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-3 Japan: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998				Period: around 1988 -- 1998				Period: around 1973 -- 1987			
Economic Variables	Regression Pair (y -x- x)	Obs	F-statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability
Money Supply	DLM -x- DLJP	249	1.28957	0.27726	DLM -x- DLJP	72	1.87902	0.16071	DLM -x- DLJP	177	0.97361	0.37979
(73:01-93:12; monthly)	DLJP -x- DLM		0.22344	0.79992	DLJP -x- DLM		1.85849	0.16386	DLJP -x- DLM		1.63838	0.19731
Inflation	DLCPI -x- DLJP	297	0.38075	0.68369	DLCPI -x- DLJP	120	0.17588	0.83895	DLCPI -x- DLJP	177	2.57782	0.07887
(73:01-97:12; monthly)	DLJP -x- DLCPI		1.25809	0.28573	DLJP -x- DLCPI		0.89763	0.41037	DLJP -x- DLCPI		2.55826	0.08038
Exchange Rate	DLEX -x- DLJP	297	1.25951	0.28533	DLEX -x- DLJP	120	0.12225	0.88504	DLEX -x- DLJP	177	2.32793	0.10056
(73:01-97:12; monthly)	DLJP -x- DLEX		0.26169	0.76993	DLJP -x- DLEX		0.44869	0.63958	DLJP -x- DLEX		1.36574	0.25794
Interest Rate(callmoney)	DLI -x- DLJP	298	1.34824	0.26131	DLI -x- DLJP	121	0.47556	0.62274	DLI -x- DLJP	177	1.54344	0.21659
(73:01-98:01; monthly)	DLJP -x- DLI		0.11983	0.88711	DLJP -x- DLI		0.41571	0.66085	**DLJP ----> DLI**		3.04494*	0.05017
G-Bond (long-term)	**DLGB---->DLJP**	298	3.29042*	0.03862	DLGB -x- DLJP	121	1.06908	0.34668	**DLGB---->DLJP**	177	10.3088*	0.00005
(73:01-98:01; monthly)	DLJP -x- DLGB		2.31637	0.10043	DLJP -x- DLGB		1.15255	0.31942	DLJP -x- DLGB		1.87985	0.15573
Co-Bond (low-grade)	**DLCB---->DLJP**	297	2.91218*	0.05594	DLCB -x- DLJP	120	0.28962	0.74909	**DLCB---->DLJP**	177	5.64551*	0.00422
(73:01-97:12; monthly)	DLJP -x- DLCB		1.44796	0.23673	DLJP -x- DLCB		1.76089	0.17649	DLJP -x- DLCB		0.38097	0.68378
Term Structure	TS -x- DLJP	297	0.41993	0.65749	TS -x- DLJP	120	1.72869	0.82111	TS -x- DLJP	177	1.34819	0.26244
(73:01-98:01; monthly)	DLJP -x- TS		2.36027	0.09619	DLJP -x- TS		0.08121	0.92205	**DLJP ----> TS**		5.83792*	0.00352
Default Risk Premium	DR -x- DLJP	297	0.82621	0.43873	DR -x- DLJP	120	1.35629	0.26171	**DR ---->DLJP**	177	3.74671*	0.02254
(73:01-97:12; monthly)	DLJP -x- DR		0.08022	0.50731	DLJP -x- DR		0.16779	0.84574	DLJP -x- DR		0.75349	0.47227
Industrial Production	DLIP -x- DLJP	297	0.84163	0.43205	DLIP -x- DLJP	120	0.33658	0.71491	DLIP -x- DLJP	177	0.73981	0.47872
(73:01-97:12; monthly)	DLJP -x- DLIP		0.36862	0.69201	DLJP -x- DLIP		0.10297	0.90224	DLJP -x- DLIP		1.50321	0.22532
Trade Balance Ratio	TBR -x- DLJP	85	0.91713	0.40383	TBR -x- DLJP	28	0.41693	0.66395	TBR -x- DLJP	57	1.14643	0.32567
(73:q1-97:q3; quarterly)	DLJP -x- TBR		2.09941	0.12923	DLJP -x- TBR		0.07714	0.92601	**DLJP ----> TBR**		4.22015*	0.02003
Trade Balance	DLTR -x- DLJP	85	1.35949	0.26266	DLTR -x- DLJP	28	1.00688	0.38091	DLTR -x- DLJP	57	1.93859	0.15417
(73:q1-97:q3; quarterly)	DLJP -x- DLTR		0.99895	0.37281	DLJP -x- DLTR		0.77508	0.47233	DLJP -x- DLTR		2.57371	0.08594
Gross National Product	DLGNP-x-DLJP	96	0.45266	0.63736	DLGNP-x-DLJP	39	0.15177	0.85976	**DLGNP-->DLJP**	56	10.1998*	0.00019
(73:q1-97:q3; quarterly)	DLJP-x-DLGNP		0.19925	0.81971	DLJP-x-DLGNP		0.04931	0.95195	DLJP-x-DLGNP		2.84393	0.06946
Private Consumption	DLPC x- DLJP	96	1.02542	0.036275	DLPC x- DLJP	39	0.53239	0.59202	**DLPC ---->DLJP**	57	8.03174*	0.00091
(73:q1-97:q3; quarterly)	DLJP -x- DLPC		0.28115	0.75557	DLJP -x- DLPC		0.67889	0.51392	DLJP -x- DLPC		0.94828	0.39401
Consumption per capital	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-4 Korea: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998				Period: around 1988 -- 1998				Period: around 1973 -- 1987			
Economic Variables	Regression Pair (y -x- x)	Obs	F-statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability	Regression Pair (y -x- x)	Obs	F-Statistic	Probability
Money Supply	DLM -x- DLKO	225	0.02517	0.97514	DLM -x- DLKO	72	0.43831	0.64696	DLM -x- DLKO	153	1.16871	0.31362
(75:01-93:12; monthly)	DLKO -x- DLM		1.54997	0.21456	DLKO -x- DLM		1.05377	0.35433	DLKO -x- DLM		0.73558	0.48097
Inflation	DLCPI -x- DLKO	273	0.37223	0.68955	DLCPI -x- DLKO	120	0.07074	0.93174	DLCPI -x- DLKO	153	1.22551	0.25657
(75:01-97:12; monthly)	DLKO -x- DLCPI		0.09617	0.90834	DLKO -x- DLCPI		0.16756	0.84593	DLKO -x- DLCPI		0.12713	0.88071
Exchange Rate	**DLEX---->DLKO**	272	6.16878*	0.00241	DLEX -x- DLKO	120	2.29431	0.10543	**DLEX---->DLKO**	152	5.93889*	0.00331
(75:01-97:12; monthly)	DLKO -x- DLEX		2.48713	0.08507	DLKO -x- DLEX		1.50783	0.22573	DLKO -x- DLEX		2.66144	0.07321
Interest Rate(callmoney)	**DLI ----> DLKO**	252	5.66975*	0.00391	**DLI ----> DLKO**	118	4.95567*	0.00865	DLI -x- DLKO	134	2.09175	0.12764
(76:08-97:10; monthly)	DLKO -x- DLI		2.56888	0.07867	DLKO -x- DLI		1.78125	0.17312	DLKO -x- DLI		0.43281	0.64962
G-Bond (long-term)	DLGB -x- DLKO	185	1.29811	0.27559	DLGB -x- DLKO	120	1.04221	0.35598	DLGB -x- DLKO	65	0.33042	0.71992
(82:05-97:12; monthly)	DLKO -x- DLGB		0.41543	0.66068	DLKO -x- DLGB		0.59375	0.55394	DLKO -x- DLGB		0.29555	0.74521
Co-Bond (low-grade)	**DLCB---->DLKO**	215	11.8306*	0.00001	**DLCB---->DLKO**	122	11.3675*	0.00003	DLCB -x- DLKO	93	0.1389	0.87051
(80:01-98:02; monthly)	DLKO -x- DLCB		0.19915	0.81958	DLKO -x- DLCB		0.09625	0.90831	DLKO -x- DLCB		1.19964	0.30618
Term Structure	**TS ---->DLKO**	183	3.17968	0.04397	**TS ---->DLKO**	118	3.01196*	0.05316	TS -x- DLKO	65	0.76935	0.46783
(82:05-97:10; monthly)	DLKO -x- TS		1.00173	0.36931	DLKO -x- TS		1.99679	0.14053	DLKO -x- TS		1.25346	0.29288
Default Risk Premium	DR -x- DLKO	185	0.66973	0.51312	DR -x- DLKO	120	1.20494	0.30346	DR -x- DLKO	65	0.26155	0.77073
(82:05-97:12; monthly)	DLKO -x- DR		1.34285	0.26371	DLKO -x- DR		0.71952	0.48917	DLKO -x- DR		0.57709	0.56462
Industrial Production	DLIP -x- DLKO	272	2.14873	0.11864	DLIP -x- DLKO	119	0.12138	0.88581	**DLIP ---->DLKO**	153	4.40352*	0.01388
(75:01-97:11; monthly)	DLKO -x- DLIP		0.42573	0.65373	DLKO -x- DLIP		0.50296	0.60607	**DLKO----> DLIP**		3.13311*	0.04649
Trade Balance Ratio	TBR -x- DLKO	77	0.28371	0.75381	TBR -x- DLKO	28	1.70192	0.20397	TBR -x- DLKO	49	0.05773	0.94398
(75:q1-94:q4; quarterly)	DLKO -x- TBR		1.07637	0.34625	DLKO -x- TBR		2.25128	0.12796	DLKO -x- TBR		0.22566	0.79891
Trade Balance	DLTR x- DLKO	77	0.73825	0.48153	DLTR x- DLKO	28	1.80789	0.18654	DLTR x- DLKO	49	0.31694	0.73002
(75:q1-94:q4; quarterly)	DLKO -x- DLTR		0.21131	0.81003	DLKO -x- DLTR		0.76079	0.47871	DLKO -x- DLTR		0.34116	0.71281
Gross National Product	DLGNP-x-DLKO	85	0.22931	0.79561	DLGNP-x-DLKO	36	2.33418	0.11369	DLGNP-x-DLKO	49	0.87079	0.42571
(75:q1-96:q4; quarterly)	DLKO-x-DLGNP		0.03877	0.96199	DLKO-x-DLGNP		6.75601	0.47801	DLKO-x-DLGNP		0.48413	0.61948
Private Consumption	DLPC -x- DLKO	85	0.23306	0.79264	DLPC -x- DLKO	36	1.70708	0.19806	DLPC -x- DLKO	49	1.98833	0.14904
(75:q1-96:q4; quarterly)	DLKO -x- DLPC		0.09782	0.90892	DLKO -x- DLPC		0.32314	0.72628	DLKO -x- DLPC		0.90178	0.41321
Consumption per capital	na na	na	na	na	na na	na	na	na	na na	na	na	na
	na na	na	na	na	na na	na	na	na	na na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-5 Malaysia: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998					Period: around 1988 -- 1998					Period: around 1973 -- 1987				
Economic Variables	Regression Pair		Obs	F-statistic	Probability	Regression Pair		Obs	F-Statistic	Probability	Regression Pair		Obs	F-Statistic	Probability
	y	x				y	x				y	x			
Money Supply	DLM	-x- DLMY	163	1.63817	0.19762	DLM	-x- DLMY	71	0.95492	0.39011	DLM	-x- DLMY	92	0.61016	0.54557
(80:02-93:11; monthly)	DLMY	-x- DLM		0.05119	0.95011	DLMY	-x- DLM		1.31283	0.27599	DLMY	-x- DLM		1.25324	0.29068
Inflation	DLCPI	-x- DLMY	211	1.69554	0.18605	DLCPI	-x- DLMY	119	0.87135	0.42116	DLCPI	-x- DLMY	92	0.92391	0.40082
(80:02-97:11; monthly)	DLMY	-x- DLCPI		2.55976	0.07978	**DLMY--->DLCPI**			3.63447*	0.02951	DLMY	-x- DLCPI		0.54422	0.58226
Exchange Rate	**DLEX---->DLMY**		212	6.36827*	0.00207	**DLEX---->DLMY**		120	8.79749*	0.00028	DLEX	-x- DLMY	92	1.09194	0.34012
(80:02-97:12; monthly)	DLMY	-x- DLEX		0.20367	0.81589	DLMY	-x- DLEX		0.61168	0.54419	DLMY	-x- DLEX		0.25911	0.77233
Interest Rate(callmoney)	DLI	-x- DLMY	176	2.38634	0.09502	DLI	-x- DLMY	84	0.45694	0.63488	DLI	-x- DLMY	92	1.77182	0.17611
(80:02-94:12; monthly)	DLMY	-x- DLI		1.0621	0.36414	DLMY	-x- DLI		0.17437	0.84031	DLMY	-x- DLI		0.77099	0.46569
G-Bond (long-term)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Co-Bond (low-grade)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Term Structure	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Default Risk Premium	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Industrial Production	DLIP	-x- DLMY	209	1.71125	0.18322	DLIP	-x- DLMY	117	1.18343	0.31003	DLIP	-x- DLMY	92	0.61027	0.54551
(80:02-97:09; monthly)	**DLMY ---->DLIP**			3.57624*	0.02975	**DLMY ---->DLIP**			4.61431*	0.01187	DLMY	-x- DLIP		0.68621	0.50619
Trade Balance Ratio	TBR	-x- DLMY	10	1.14424	0.32025	TBR	-x- DLMY	6	0.01222	0.91895	TBR	-x- DLMY	4	1.61031	0.42488
(81 - 93; annually)	DLMY	-x- TBR		0.07038	0.79842	DLMY	-x- TBR		5.35891	0.10356	DLMY	-x- TBR		53.277	0.08668
Trade Balance	DLTR	x- DLMY	10	0.31271	0.59345	DLTR	x- DLMY	6	0.03632	0.96555	DLTR	x- DLMY	4	0.05726	0.85048
(81 - 93; annually)	DLMY	-x- DLTR		1.01339	0.34761	DLMY	-x- DLTR		21.2761	0.15153	DLMY	-x- DLTR		0.00085	0.98142
Gross National Product	DLGNP	-x-DLMY	13	0.45965	0.51317	DLGNP	-x-DLMY	9	0.28726	0.61162	**DLGNP-->DLMY**		4	467.731*	0.02942
(81 - 96; annually)	DLMY	-x-DLGNP		1.45234	0.25591	DLMY	-x-DLGNP		0.20087	0.66975	DLMY	-x-DLGNP		1.85693	0.40303
Private Consumption	DLPC	x- DLMY	12	0.44385	0.65844	DLPC	x- DLMY	9	0.77146	0.52077	DLPC	x- DLMY	4	0.05726	0.85048
(81 - 96; annually)	DLMY	-x- DLPC		1.68089	0.25341	DLMY	-x- DLPC		2.95698	0.16279	DLMY	-x- DLPC		0.00085	0.98142
Consumption per capital	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-6 Singapore: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998					Period: around 1988 -- 1998					Period: around 1973 -- 1987				
Economic Variables	Regression Pair		Obs	F-statistic	Probability	Regression Pair		Obs	F-Statistic	Probability	Regression Pair		Obs	F-Statistic	Probability
	y	x				y	x				y	x			
Money Supply	DLM	-x- DLSG	96	1.76187	0.17779	DLM	-x- DLSG	72	1.70231	0.19005	na	na	na	na	na
(86:02-93:12; monthly)	DLSG	-x- DLM		0.65131	0.52389	DLSG	-x- DLM		1.87022	0.16205	na	na	na	na	na
Inflation	DLCPI	-x- DLSG	137	0.94954	0.38955	DLCPI	-x- DLSG	117	0.68298	0.5072	na	na	na	na	na
(86:02-97:09; monthly)	DLSG	-x- DLCPI		0.01114	0.98892	DLSG	-x- DLCPI		0.13266	0.87591	na	na	na	na	na
Exchange Rate	DLEX	-x- DLSG	140	0.99407	0.37276	DLEX	-x- DLSG	119	1.62956	0.20055	na	na	na	na	na
(86:02-97:12; monthly)	DLSG	-x- DLEX		0.02969	0.97076	DLSG	-x- DLEX		0.46489	0.62939	na	na	na	na	na
Interest Rate(callmoney)	DLI	-x- DLSG	139	0.04995	0.95129	DLI	-x- DLSG	119	0.25469	0.77561	na	na	na	na	na
(86:02-97:11; monthly)	DLSG	-x- DLI		1.74288	0.17896	DLSG	-x- DLI		1.93658	0.14891	na	na	na	na	na
G-Bond (long-term)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Co-Bond (low-grade)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Term Structure	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Default Risk Premium	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Industrial Production	DLIP	-x- DLSG	42	0.64731	0.52928	DLIP	-x- DLSG	38	0.59245	0.55874	na	na	na	na	na
(86:q2-97:q2; quarterly)	DLSG	-x- DLIP		0.73781	0.48507	DLSG	-x- DLIP		0.44972	0.64165	na	na	na	na	na
Trade Balance Ratio	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Trade Balance	DLTR	-x- DLSG	140	0.86064	0.42521	DLTR	-x- DLSG	120	0.83452	0.43671	na	na	na	na	na
(86:02-97:12; monthly)	DLSG	-x- DLTR		0.13395	0.87475	DLSG	-x- DLTR		0.32918	0.72019	na	na	na	na	na
Gross National Product	DLGNP	-x-DLSG	6	2.79771	0.38938	na	na	na	na	na	na	na	na	na	na
(87 - 96; annually)	DLSG	-x-DLGNP		0.31057	0.78541	na	na	na	na	na	na	na	na	na	na
Private Consumption	DLPC	x- DLSG	6	21.2357	0.15167	na	na	na	na	na	na	na	na	na	na
(87 - 96; annually)	DLSG	-x- DLPC		3.558478	0.34987	na	na	na	na	na	na	na	na	na	na
Consumption per capital	PCP	x- DLSG	6	0.53271	0.69582	na	na	na	na	na	na	na	na	na	na
(87 - 96; annually)	DLSG	-x- PCP		23.1448	0.14542	na	na	na	na	na	na	na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-7 Taiwan: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998				Period: around 1988 -- 1998				Period: around 1973 -- 1987				
Economic Variables	Regression Pair y x	Obs	F-statistic	Probability	Regression Pair y x	Obs	F-Statistic	Probability	Regression Pair y x	Obs	F-Statistic	Probability	
Money Supply	**DLM---->DLTW**	143	3.78671*	0.02506	**DLM---->DLTW**	122	4.58441*	0.01211	na na	na	na	na	
(86:01-98:02; monthly)	DLTW -x- DLM		0.16607	0.84716	DLTW -x- DLM		0.01809	0.98208	na na	na	na	na	
Inflation	DLCPI -x- DLTW	141	1.03484	0.35806	DLCPI -x- DLTW	120	2.68101	0.07277	na na	na	na	na	
(86:01-97:12; monthly)	DLTW -x- DLCPI		0.34618	0.70801	DLTW -x- DLCPI		1.54225	0.21829	na na	na	na	na	
Exchange Rate	DLEX x- DLTW	1582	0.25601	0.77416	na na	na	na	na	na na	na	na	na	
(92:01:06-98:01:30;daily)	**DLTW--->DLEX**		6.16447*	0.00215	na na	na	na	na	na na	na	na	na	
Treasury Bill Rate	DLTB -x- DLTW	136	0.96161	0.38496	DLTB -x- DLTW	115	1.06659	0.34771	na na	na	na	na	
(86:01-97:07; monthly)	DLTW -x- DLTB		2.79735	0.06462	DLTW -x- DLTB		1.41556	0.24718	na na	na	na	na	
G-Bond (long-term)	**DLGB---->DLTW**	110	0.13647	0.87259	na na	na	na	na	na na	na	na	na	
(86:01-95:05; monthly)	DLTW -x- DLGB		0.04321	0.95774	na na	na	na	na	na na	na	na	na	
Co-Bond (low-grade)	**DLCB---->DLTW**	142	10.0005*	0.00008	**DLCB---->DLTW**	121	5.39177*	0.00577	na na	na	na	na	
(86:01-98:01; monthly)	DLTW -x- DLCB		2.02086	0.13648	**DLTW---->DLCB**		3.48419*	0.03393	na na	na	na	na	
Term Structure	TS -x- DLTW	110	0.63621	0.53132	TS -x- DLTW	89	0.81106	0.44783	na na	na	na	na	
(86:01-95:05; monthly)	DLTW -x- TS		2.23997	0.11153	DLTW -x- TS		1.28987	0.28071	na na	na	na	na	
Default Risk Premium	**DR -----> DLTW**	110	8.35505*	0.00043	**DR -----> DLTW**	89	4.17939*	0.01861	na na	na	na	na	
(86:01-95:05; monthly)	DLTW -x- DR		1.81733	0.16753	**DLTW---->DR**		3.01465*	0.0544	na na	na	na	na	
Industrial Production	DLIP -x- DLTW	141	0.46134	0.63142	DLIP -x- DLTW	120	0.32742	0.72145	na na	na	na	na	
(86:01-97:12; monthly)	DLTW -x- DLIP		0.15292	0.85834	DLTW -x- DLIP		0.55857	0.57357	na na	na	na	na	
Trade Balance Ratio	**TBR---->DLTW**	36	14.2063*	0.00004	na na	na	na	na	na na	na	na	na	
(88:q1-97:q3; quarterly)	DLTW -x- TBR		0.05869	0.94311	na na	na	na	na	na na	na	na	na	
Trade Balance	DLTR x- DLTW	36	0.08604	0.91778	na na	na	na	na	na na	na	na	na	
(88:q1-97:q3; quarterly)	DLTW -x- DLTR		0.44344	0.65214	na na	na	na	na	na na	na	na	na	
Gross National Product	DLGNP-x-DLTW	44	0.53035	0.59258	DLGNP-x-DLTW	39	0.22598	0.79893	na na	na	na	na	
(86:q1-97:q3; quarterly)	DLTW-x-DLGNP		1.22541	0.30471	DLTW-x-DLGNP		1.77562	0.18473	na na	na	na	na	
Private Consumption	DLPC x- DLTW	44	0.36889	0.69389	DLPC x- DLTW	39	0.77834	0.46718	na na	na	na	na	
(86:q1-97:q3; quarterly)	DLTW -x- DLPC		0.16662	0.84712	DLTW -x- DLPC		0.18602	0.83111	na na	na	na	na	
Consumption per capital	na na	na	na	na	na na	na	na	na	na na	na	na	na	
	na na	na	na	na	na na	na	na	na	na na	na	na	na	

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

Table 5.4-8 Thailand: Pairwise Granger Causality Tests

	Period: around 1973 -- 1998					Period: around 1988 -- 1998					Period: around 1973 -- 1987				
Economic Variables	Regression Pair		Obs	F-statistic	Probability	Regression Pair		Obs	F-Statistic	Probability	Regression Pair		Obs	F-Statistic	Probability
	y	x				y	x				y	x			
Money Supply	DLM	-x- DLTH	175	0.07092	0.93157	DLM	-x- DLTH	70	0.31041	0.73424	DLM	-x- DLTH	105	0.32201	0.72544
(79:01-93:10; monthly)	DLTH	-x- DLM		0.02083	0.97939	DLTH	-x- DLM		1.29167	0.28177	DLTH	-x- DLM		1.61227	0.20458
Inflation	DLCPI	-x- DLTH	214	0.74824	0.47446	DLCPI	-x- DLTH	121	0.63062	0.53408	DLCPI	-x- DLTH	93	0.18921	0.82796
(80:01-98:01; monthly)	DLTH	-x- DLCPI		0.05317	0.94823	DLTH	-x- DLCPI		0.32522	0.72302	DLTH	-x- DLCPI		1.13406	0.32638
Exchange Rate	**DLEX**	**--->DLTH**	1845	10.3978*	0.00003	na	na	na	na	na	na	na	na	na	na
(91:01:02-98:01:30; daily)	DLTH	-x- DLEX		1.17333	0.30975	na	na	na	na	na	na	na	na	na	na
Interest Rate(callmoney)	DLI	-x- DLTH	89	1.05813	0.35168	na	na	na	na	na	na	na	na	na	na
(88:10-96:05; monthly)	**DTH**	**---->DLI**		3.38908*	0.03842	na	na	na	na	na	na	na	na	na	na
G-Bond (long-term)	DLGB	-x- DLTH	206	0.03954	0.96124	DLGB	-x- DLTH	113	1.35281	0.26286	DLGB	-x- DLTH	93	0.78266	0.46034
(80:01-97:05; monthly)	DLTH	-x- DLGB		0.15679	0.85499	DLTH	-x- DLGB		0.01895	0.98123	DLTH	-x- DLGB		0.46543	0.62941
Co-Bond (low-grade)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Term Structure	TS	-x- DLTH	89	1.18246	0.31157	na	na	na	na	na	na	na	na	na	na
(88:10-96:05; monthly)	**DLTH**	**---->TS**		3.67761*	0.02944	na	na	na	na	na	na	na	na	na	na
Default Risk Premium	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Industrial Production	DLIP	-x- DLTH	70	0.44456	0.64304	DLIP	-x- DLTH	61	1.47131	0.23837	na	na	na	na	na
(87:01-93:01; monthly)	DLTH	-x- DLIP		2.62986	0.07975	DLTH	-x- DLIP		2.08895	0.13336	na	na	na	na	na
Trade Balance Ratio	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Trade Balance	DLTR	x- DLTH	213	0.19228	0.82523	DLTR	x- DLTH	120	0.03309	0.96746	DLTR	x- DLTH	93	0.40952	0.66523
(80:01-97:12; monthly)	DLTH	-x- DLTR		0.34632	0.70769	DLTH	-x- DLTR		0.44179	0.64397	DLTH	-x- DLTR		0.21619	0.80601
Gross National Product	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Private Consumption	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Consumption per capital	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na

* Indicates significance at 5% level (reject Ho: y (or x) does not Granger Cause x (or y)).

5.5 Conclusion

This chapter adopts Granger Causality analysis to investigate the relationship between eight Asia-Pacific stock markets and their macroeconomic fundamentals including money supply, inflation, exchange rate, call money rate, yield on government bonds, corporate bond rate, term structure, default risk premium, industrial production, trade balance, gross national product, and private consumption.

The findings show that the exchange rate and corporate bond yield appear to have Granger-caused stock returns in most of the stock markets in the Asia-Pacific region rather than other macroeconomic variables while inflation, money supply and the trade balance do not Granger-cause stock returns. In short, the results are consistent with the view that stock returns only respond to monetary variables. However, this study also finds that most of the macroeconomic fundamentals in most of the Asia-Pacific countries are not predictors of stock returns, and hence, information captured in these stock markets do not reflect changes in the macroeconomic variables.

The overall conclusion is that much of the movement in Asian-Pacific stock markets appears to be quite independent of changes in fundamental economic conditions regardless of financial liberalization. Hence, one possible implication is that stock markets in the Asia-Pacific region do not satisfy the criteria for full informational

efficiency [203] and this may be evidence that Asia-Pacific stock markets are subject to speculative bubbles and fads as mentioned earlier in the chapter.

[203] See Fama (1991) and section 2.2.1.

Chapter 6 Conclusion

6.1 Summary and Conclusion

The spectacle of price collapses around the world in the stock market crash of October 1987 and the rapid development of emerging stock markets (e.g. in the Asia-Pacific region) raise issues about the gains from risk-diversification, market integration and the effect of financial liberalization.

Indeed, a review of the existing literature (ch. 2) shows that co-movements exist among the world's major stock markets and that, in a limited sense, these markets seem to have been moving toward integration since the late 1980s. Yet research also finds that stock markets within some regions, such as the Nordic-region (Mathur and Subrahmanyam, 1992) or the Asia's NIEs (Chowdhury, 1994), are less than fully integrated. This implies that the existence of emerging markets is beneficial for diversification from developed markets and within regional emerging markets themselves.

As far as financial liberalization is concerned (ch. 1), Asia-Pacific stock markets prior to the 1980s were underdeveloped and played a minor role in intermediating funds. During the 1980s, many countries in the region liberalized their financial systems. Among them, Hong Kong was the first fully liberalized market, followed by Australia, Malaysia and Singapore. Japan and Thailand are both fully liberalized with few

exceptions. Unlike Japan, Thailand started its financial liberalization relatively late, but at a faster pace and to a greater degree than other countries in the region. Similar to Thailand, Taiwan has exhibited a relatively fast pace of financial liberalization. Thus Taiwan, as well as Korea with its slow pace of financial liberalization, both started financial liberalization very late and are now substantially open but not completely liberalized.

In attempting to address the above issues, this study investigated the existence of inter-relationships among Asia-Pacific stock markets (chs. 3 and 4) and examined the 'causal' relationships between individual stock markets and macroeconomic fundamentals within the Asia-Pacific region (ch. 5). Additionally, in order to investigate the effects of a major international event, such as the October1987 crash, as well as national evens, such as financial liberalization, on these regional stock markets, the data set in this study was divided into two sub-periods. The study identified the first sub-period as a period when most Asia-Pacific stock markets were less accessible to foreign investors and the second sub-period as a period with a higher level of financial liberalization. The two sub-periods also correspond to the pre-and post- financial crash of October 1987.

The empirical investigations of this study, however, suggest that financial liberalization has enhanced the inter-relationships among Asia-Pacific stock markets and that high capital controls account for instances of low interactions and vice versa. The

evidence in this study also shows that the effects of a shock to stock markets are completed within two days, indicating that stock markets adjust quickly, but not instantaneously, to all relevant information in the Asia-Pacific region. Moreover, this study also finds that Japan and Hong Kong are the most influential markets in terms of their effects on other markets within the region.

An interesting finding was the existence of high correlation but no cointegration in the second sub-period. It indicates that the absence of cointegration may simply rule out the existence of a long-run equilibrium tending relationship, but it does not invalidate any short-run relationships which may arise due to profit-seeking opportunities in transactions. However, an alternative interpretation of this finding is that, according to the traditional definition of market efficiency, after a period of financial deregulation Asia-Pacific stock markets move closely in the short-term and eventually increase their market efficiency in the long-term.

Next this study searched for the effects of macroeconomic fundamentals on domestic stock markets. The results from the existing literature on the relationship of stock markets to fundamental economic activities in the Asia-Pacific region have not been conclusive. One counter argument is that the stock markets in the Asia-Pacific region are much smaller in size as compared to the developed markets (such as the US), hence, they may be more vulnerable to speculative bubbles and fads. If so, then the stock markets in Asia-Pacific countries may not be tied to fundamentals. Indeed,

the results of this study are consistent with this view. As evidence, the empirical finding shows that most of the macroeconomic fundamentals are not the predictors of stock returns and that information captured in the stock market does not reflect changes in macroeconomic fundamentals.

Overall, this study reaches three important conclusions:

First, the results suggest that not only has financial liberalization enhanced the interactions between stock markets, but importantly, the degree of financial liberalization may have an impact on the role and interaction of Asia-Pacific stock markets.

Second, the result of the absence of cointegration may simply rule out the existence of a long-run equilibrium tending relationship, but does not invalidate any short-run relationships which may arise due to profit-seeking opportunities in transactions. Hence, as far as the surge of equity investment flows into Asia-Pacific stock markets due to financial liberalization is concerned, this study suggests that diversification within the region by short-term investors would not have been a strongly beneficial strategy, but long-term investment would have been.

Third, much of the movement in Asia-Pacific stock markets appears to be quite independent of changes in fundamental economic conditions. Hence, one possible implication is that stock markets in the region do not satisfy the criteria for full informational efficiency[205] and it may be evidence that Asia-Pacific stock markets are

[205] See Fama (1991) and section 2.2.1.

subject to speculative bubbles and fads.

The turbulence in Asia-Pacific countries in October 1997 suggests that Asia-Pacific stock markets can be expected to be more vulnerable to external shocks as capital inflows continue to increase, particularly short-term speculative activities. Hence, the conclusions of this study are crucial to urging Asia-Pacific countries to set up regulations or formulate policies regarding capital flows both to and out of their countries.

6.2 Discussion and Future Research

This study has attempted to investigate stock market integration, as well as stock returns and macroeconomic fundamentals within the Asia-Pacific region. However, some issues are left unanswered by this study. The first one relates to the stock market data. The others imply widening and deepening the scope of stock markets coverage. This section, therefore, provides a brief discussion of these issues.

One limitation faced by this study, and several others involoving Asia-Pacific finance research, is the lack of high quality, comprehensive data.[206] The data limitation is a particular problem for Chapter 5 on stock returns and macroeconomic fundamental analysis.[207] Although the Granger Causality approach adopted in that chapter can detect the pairwise 'causal' relationships between stock returns and macroeconomic fundamentals, it is difficult to regard it as a fully-fledged alternative to a more formal asset pricing approach because of some of the shortcomings. Previous studies on relationships between stock markets and economic variables concerned developed markets, such as the US market, where high quality data are available and the multi-factor model, such as the APT model, were applied.[208] It is suggested that the multi-

[206] For example, lack of daily exchange rate index, as well as some macroeconomic fundamentals are in different frequencies or not available in most of the Asia-Pacific countries.

[207] Since most macroeconomic variables in Asia-Pacific countries are either not available or in different frequencies, Chapter 5 only applies pairwise Granger Causality tests rather than multi-factor models, such as APT model.

[208] See Chapter 2 for detail discussion on multi-factor model and other relative literature.

factor APT model should be applied in future research related to stock returns and macroeconomic fundamentals if improvement can be made in the quality of data for Asia-Pacific countries.

As one of the objectives was to investigate interactions within regional markets, this study has only focused on stock markets within the Asia-Pacific region and it has ignored inter-relationships between Asia-Pacific markets and with stock markets outside the region. Hence, to detect market integration in the global context, this study could be developed further as follows: Firstly, further research could investigate whether large capital flows into the Asia-Pacific region, especially from developed countries, are reflected in these stock markets. One possible way to examine the issue is that the tests in both Chapter 3 and 4 on interrelationships among stock markets could be expanded further by including data sets from other developed stock markets (e.g. the US) and other emerging or developing stock markets. Secondly, research could be pursued to show how stocks are priced globally and to test whether stock markets are integrated regionally or internationally. Chapter 5 on stock returns and macroeconomic fundamentals can be improved further by applying international arbitrage pricing theory (IAPT). Thus, it is possible to examine both the impacts of other stock markets and domestic macroeconomic variables on individual stock markets in an IAPT model. Finally, this study has not investigated the dynamic interactions between changes in direct or indirect barriers to investment and market returns. In future work, approaches

incorporating global and domestic factors jointly with quantitative indicators of direct or indirect barriers to investment should be explored.

Overall, the crash of 1987 and the turbulence in Asia-Pacific countries in October 1997 may suggest that market behavior may be self-fulfilling and therefore divorced from standard economic considerations of valuation. In short, these events were caused by the bursting of speculative price bubbles. Having recognized the current situation of Asia-Pacific stock markets, one area for future research comes to mind. That is: to test the effects of speculation on the stability of the stock market. One suggestion is to test whether speculative activity and volatility are significantly related. Alternatively, one may examine market crises using macroeconomic variables to extract a measure of relative speculative behavior.

Appendix 1 A Chronology of Financial Liberalization in Asia-Pacific Countries

1970	Singapore	* Entry of foreign banks into Singapore is liberalized.
1971	Australia	* Banks allowed to act in foreign exchange market as principals, rather than as agent of central bank. * Surveillance by Reserve Bank of capital inflows.
	Japan	* Book Entry Clearing System for stocks introduced.
1972	Australia	* Interest rate restrictions lifted on large overdrafts. Embargo on foreign borrowings of less than two years. Constraints on overseas borrowings in Australia lifted. VDRs (variable deposit requirements) introduced requiring a non-interest bearing deposit equal to one quarter of foreign borrowing to be lodged with the Reserve Bank.
	Hong Kong	* Most control on capital flows are lifted. * Exchange controls are abolished.
	Korea	* Investment and finance companies established for absorbing open-market fund.
	Malaysia	* Interest rate ceilings on commercial bank deposits with maturity exceeding one year are lifted.
	Singapore	* 20 percent liquidity ratio for Asia currency unit (ACU) is abolished.
1973	Australia	* Interest rate restrictions lifted on large CDs.
	Japan	* Yen-based foreign bonds listed for the first time. * Foreign Stock Section opened.
	Malaysia	* Interest rate ceilings on all finance company deposits are lifted. * Discount rates for treasury bills are determined by open tender in the money market. * With the termination of currency interchangeability between Malaysia and Singapore, the Stock Exchange of Malaysia is split into the Kuala Lumpur Stock Exchange and the Stock Exchange of Singapore, although many Malaysian companes continue to be listed on the stock Exchange of Singapore, and vice versa.

		* Exchange controls abolished.
		* The Malaysian ringgit is allowed to float.
	Singapore	* Stock Exchange of Singapore (SES) opens.
		* Dealings in the gold market are completely liberalized to allow resident participation.
		* Offshore banking licenses are issued to seven foreign banks.
		* Corporate tax of ACU on interest earnings from overseas loans is reduced to 10 percent from 40 percent.
		* Interest received by non-resident holders of approved Asian dollar bonds is exempted from tax.
1974	Australia	* Financial Corporations Act became operative.
		* Select Committee on Securities and Exchange publishes five-volume report documenting unsatisfactory nature of new issue market, company reporting and the securities industry.
		* VDRs Successively lowered and then dropped; and restrictions on foreign inflows relaxed.
	Hong Kong	* The Hong Kong dollar was allowed to float freely.
	Japan	* Market Information System (MIS) put into operation.
	Malaysia	* Interest rate restrictions abolished on finance companies.
1975	Japan	* Abolition of Bank of Japan guideline on loan rates.
	Malaysia	* No limitation on capital flows as long as they are not financed by local borrowing in Malaysia.
	Singapore	* Cartel system of determining interest rates is abolished. Bank are free to quote their own rates of interest.
	Thailand	* Securities Exchange of Thailand begins trading.
1976	Australia	* Australian Savings Bond (ASBs) replace Special Bonds.
		* Australian dollars devalued; 'flexible peg' exchange rate system adopted. Australians permitted to trade in gold.
	Hong Kong	* The Securities (Stock Exchange Listing) Rule introduced.
	Japan	* Preexisting government-bond repurchase market (the gensaki market) officially recognized.
	Singapore	* Nonresident deposits with ACUs and approved Asian

		dollar bonds held by nonresidents are exempted from Singapore estate duty.
	Taiwan	* Establishment of a bill-exchange market.
1977	Australia	* Restoration of restraints on capital inflows, VDR restored and set at one-quarter. Later in the year, these measures were reversed.
	Japan	* Ad valorem brokerage commission system introduced.
	Singapore	* ASEAN Preferential Trading Arrangement is formed.
1978	Australia	* Further relaxation of constraints on foreign borrowing and investment.
	Hong Kong	* Stamp duty on securities dealing is reduced.
	Japan	* Medium-term government bonds sold on a bidding basis; bank of Japan to purchase government bonds from syndicate members on a bidding basis.
	Malaysia	* Most interest rate restrictions (informal restrictions on prime lending rates and formal restrictions on rates for priority sections were retained) abolished; new money market instruments – banker's acceptances and CDs – introduced.
	Singapore	* Exchange control is completely liberalized. Residents are free to borrow and lend in all currencies as well as deal freely in foreign exchange.
		* Gold Exchange of Singapore begins operations as the first gold futures market in the Asia-Pacific region.
1979	Australia	* Campbell Committee established.
		* Interest rates futures traded. Banks enter hedge market.
		* Tender system for Treasury notes introduced.
	Japan	* Introduction of large-denomination certificates of deposit. Bank allowed to issue large CDs at competitive interest rates.
	Malaysia	* Negotiable certificates of deposit and bankeer's acceptance are introduced.
	Singapore	* Income earned from offshore general reinsurance business is granted a 10 percent concessionary tax rate.

	Thailand	* Security-repurchase market established.
1980	Australia	* Relaxation of controls on foreign portfolio investments. * Treasury bonds sales on tap instead of by periodic issues. * Banks permitted to have 60 percent share in merchant banks (previously 30 percent). * Ceilings lifted on bank deposit rates but controls on maturities remain. * First cash management trust established.
	Hong Kong	* The Stock Exchange of Hong Kong Ltd. is incorporated. * The Stock Exchanges Unification Ordinance 1980 is passed by the Legislative Council.
	Japan	* Restrictions on international capital flows abolished.
	Korea	* Preexisting government and corporate bond repurchase markets officially recognized. * Korean won changed from being pegged to the US dollar to a managed float.
	Singapore	* Stamp duty on ACUs offshore loan agreements and Asian dollar bond certificates is abolished.
	Thailand	* Interest rate ceilings for financial institutions freed from 15 percent limit imposed by usury law.
1981	Australia	* Restrictions on overseas investment in equities or real estate removed. * Australia Bank established (first new bank licenced for more than half a century). * Final Report of Campbell Committee.
	Japan	* All provisions of the new banking law are, in principle, applied to foreign banks.
	Korea	* Commercial paper markets established.
	Singapore	* Monitoring of the Singapore dollar against a trade-weighted basket of currencies is initiated with inflation as the policy target. * 487 protective duty rates are lowered to 5 percent from 15 percent.
1982	Australia	* Trading and savings banks given more freedom in liability

		management. End of quantitative controls on bank lending.
		* Savings bank's portfolio constraints eased.
		* Tender system for Treasury bonds.
	Japan	* TSE constitutional provisions against foreign membership deleted.
	Korea	* Nationwide commercial banks denationalized.
		* General credit restrictions abolished.
		* Preferential interest rates on export credits abolished.
		* Entries for investment and finance companies as well as mutual credit cooperatives liberalized.
	Malaysia	* Informal restrictions on the prime rate abolished.
1983	Australia	* Australian dollar floated
		* Martin Review Group appointed by Hawke government to assess Campbell Report.
		* All the controls on international transactions are lifted.
	Hong Kong	* The Hong Kong dollar has been pegged to the US dollar, the intervention currrency, at the rate of HK$ 7.8 per US$ 1.
	Malaysia	* The Islamic Banking Act of 1983 allows the establishment of Bank Islam Malaysia Berhad.
		* Non-interest-bearing government investment certificates are introduced.
		* Commercial banks and finance companies are required to declare a base lending rate based on their costs of funds; actual lending rates must be anchored to the base lending rate.
1984	Australia	* Term restrictions on time deposits at banks abolished.
		* Portfolio restrictions on life insurance companies and pension funds also abolished.
		* Authorization of non-bank dealers in foreign exchange instituted.
	Japan	* Expanded Euroyen activity authorized.
		* The 1984 Yen/Dollar Agreement provided further impetus to remove barriers to international capital flows.

	Korea	* Differentiating bank interest rates introduced within a band * Interest rate restrictions on interbank lending abolished. * Unguaranteed corporate bonds issued. * Banks allowed to issue CDs. * Cash management accounts introduced for investment and finance companies.
	Singapore	* Singapore International Monetary Exchange (SIMEX) introduces trading in the International Gold Futures Contract. * Financial futures trading is launched with a mutual offset link between the SIMEX and the Chicago Mercantile Exchange. * ACUs are allowed to issue negotiable certificates of deposit denominated in Japanese yen.
	Thailand	* Restrictions on bank lending rates reimposed. * Ceilings for loans to priority sections lowered and ceiling for nonpriority sectors raised. * Limits established on net foreign liability position for banks. * General credit restrictions abolished.
1985	Australia	* Monetary targets abolished. * Interest rate ceilings lifted on most types of small loans by banks. * Sixteen foreign banks invited to establish banking operations.
	Japan	* Yen-dominated banker's acceptance market established. * Introduction of large-denomination money market certificates. * Deregulation of large-denomination time deposits.
	Korea	* Foreign banks allowed to make use of central bank rediscount for export financing.
	Malaysia	* Owing to tight liquidity conditions, the interest rates on commercial bank and finance company deposits with a maturity of up to one year must be pegged to the deposit rate of the two lead domestic banks.
	Taiwan	* Banks allowed to set own prime lending rates within range

		established by the central bank.
	Thailand	* The baht interbank offered rate (BIBOR) is introduced. * Registration of foreign borrowing required.
1986	Australia	* Announcement that SRDs are to be phased out. * Reserve asset ratio for savings banks reduced.
	Korea	* Issue rates on certificates of deposit, guaranteed corporate bonds, and financial debentures freed.
	Singapore	* Operational Headquarters Incentive Scheme to encourage multinational corporations to locate regional headquarters in Singapore is initiated. * The Central Provident Fund Approved Investments Scheme came into effect. Under the scheme, up to 20% of investible saving can be invested in approved trustee shares, stocks, unit trusts and gold. * The Securities Industry Act and Regulations 1986 came into effect.
1987	Australia	* Reserve asset ratio of savings banks reduced to 13 percent. * Australia Stock Exchange commences operations. * Insurance and Superannuation Commission established.
	Hong Kong	* The trading restrictions in connection with bank-related brokers are relaxed.
	Malaysia	* Commercial bank base lending rates must not exceed that of the two lead banks by more than 0.5 percentage point. Finance companies are subject to similar guidelines. * Cagamas, the national mortagage corporation, issues its first mortagage-backed bonds.
	Singapore	* SES allows foreign entities to own up to 49 percent of the share capital of local stockbroking companies. * Foreign shareholders may be allowed to increase their shareholdings to 70 percent after three years.
	Taiwan	* Exchange control on current account of the balance of payments is completely abolished. Exchange control on capital account is limited only to large transactions. Yet remittance of money into Taiwan is still subject to control.

	Thailand	* The requirement that at least 30 percent of initial public offering shares on the SET must be held by small shareholders is removed. * A "foreign board" is established on the SET.
1988	Malaysia	* The Second Board on the Kuala Lumpur Stock Exchange is launched, enabling the listing of smaller companies.
	Singapore	* Tax exemption is granted on interest received from investments in Asian dollar bonds by nonresidents even if they carry on a business or have permanent establishments in Singapore. * Tax exemption is granted on income derived from unit trusts that are domiciled in Singapore and owned by nonresidents provided they are managed by approved fund managers in Singapore.
1989	Australia	* Amendments to Banking Act eliminates distinction between trading and savings banks and empowers Reserve Bank's prudential supervision.
	Hong Kong	* The All Ordinaries Index is launched by the Exchange. * The new Securities and Futures Commission (SFC) is formally established.
	Japan	* New short-term prime-rate-related average cost of funds Introduced. * Introduction of smaller-denomination money market certificates. * Deregulation of large denomination time deposits and money market certificates.
	Malaysia	* Two-tier liquid asset ratio requirements are abolished for Finance companies. Repurchase agreements are added to the list of eligible liabilities and thereby become subject to the statutory reserve requirement and the minimum liquidity ratio. * Bank Negara Malaysia issues guidelines on the operation of the corporate bond and promissory note markets. * A principal dealer system for government securities is introduced.

		* Non-trade-related swap transactions undertaken with offshore banks are subject to a daily limit. * The statutory reserve requirement is realigned to a uniform 4.5 percent for commercial banks and finance companies. * The weighted risk asset approach of the Bank for International Settlements is introduced as the uniform Method of capital adequacy assessment. * Commercial and merchant banks are allowed limited participation in several initial public offerings and privatizations. * The banking and Financial Institutions Act of 1989 places all banking institutions under the supervision of Bank Negara Malaysia.
	Singapore	* Withholding tax is exempted on swap transactions denominated in currencies other than Singapore dollars provided the transactions are carried out between ACUs and nonresidents. * Singapore becomes one of the founding members of the Asia-Pacific Economic Cooperation Forum (APEC).
	Taiwan	* The New Bank Act 1989 came into force. * Both local and foreign banks are allowed to set their own deposit and lending rates freely according to their funding cost
	Thailand	* Interest rate ceilings on time deposits with maturity exceeding one year are abolished.
1990	Hong Kong	* The minimum brokerage for each securities transaction traded on the Exchange is raised from HK$ 25 to HK$ 50. The Minimum commission rate of 0.25 % for stock broking is maintained.
	Korea	* The exchange rate system based on market average rates introducted.
	Malaysia	* Larger finance companies are allowed to issue negotiable certificates of deposit. * Two-tier liquid asset ratio requirements are abolished for commercial banks.

		* The Labuan International Offshore Financial Centre establishes a favorable tax environment, confidentiality rules, and no exchange controls for the conduct of international business activities in banking, insurance, corporate funding, investment and trust management, professional services, and other related activities. * Financial institutions engage primarily in foreign currency business for residents and nonresidents.
	Singapore	* Monetary Authority of Singapore (MAS) raises the ceiling on foreign ownership of shares in local banks to 40 percent from 20 percent.
	Thailand	* Thailand accepts obligations under the IMF's Article VIII, * Exchange controls on all current account transactions are liberalized.
1991	Australia	* Restrictions on borrowings in Australia by foreign governments lifted. * Australian Securities Commission replaces National Companies and Securities Commission. * Martin Committee Report into Banking and Deregulation.
	Hong Kong	* The Securities (Disclosure of Interests) Ordinance came into force.
	Korea	* The Government announced "the four stage interest rate deregulation plan". * Foreigners are allowed to purchase listed domestic stocks to the extent shares had been converted from overseas CB's.
	Malaysia	* Commercial banks and finance companies may declar their own base lending rates based on their own costs of funds. An institution may not lend at a rate below its base lending rate (except for loans with interest rates prescribed by Bank N egara Malaysia, such as low-cost housing loans), and the Maximum spread between the declared base lending rate and actual lending rates is 4 percentage points. * All outstanding ringgit received through swap transactions

		with, and direct borrowings from, nonresidents (including offshore banks) are included in the eligible liability base. * Interbank borrowing limits on finance companies participating in the interbank money market are lifted. * Deposit-taking activities of finance companies and merchant banks are expanded. * Discount houses are permitted to invest, trade, underwrite, and manage issues of eligible private debt securities, as approved by Bank Negara Malaysia.
	Thailand	* Individuals and companies are permitted to open limited Foreign currency accounts for direct investment purpose. * Investment funds, dividends, and loan repayments may be freely repatriated. * Purchases of foreign property and securities by residents, and large foreign direct investments or loans by residents to foreign affiliates still require central bank approval. * The SET introduces a fully computerized trading system to replace its floor trading system. * The reserve requirement ratio is replaced by the liquidity ratio: banks must still maintain at least 7 percent of deposits in securities and cash, but the definition of "securities" is broadened to include nongovernment securites.
1992	Australia	* 'One Nation' Policy package includes a proposal to permit foreign banks the option of operating as branches; applications by established locally incorporated subsidiaries to covert to branches would be considered. * Formation of the council of Financial Supervisors to coordinate the activities of the major supervisory authorities; members comprise Reserve Bank , the Insurance and Superannuation Commission, the Australian Securities Commission, and the Australian Financial Institutions Commission.

Hong Kong	* The compulsory Broker's fidelity Insurance Scheme came into effect.
Japan	* Introduction of saving deposits at free, floating interest rates.
Korea	* Foreign investors have been allowed to purchase domestic securities directly, but their holdings are still limited to a pre-determined ceiling of 10 percent.
Malaysia	* Rating Agency Malaysia Berhad is established to rate debt issues by corporations. * Non-trade-related swaps with all foreign customers are subjects to a daily limit. * Trading on the Kuala Lumpur Stock Exchange becomes fully automated.
Singapore	* Stock Exchange of Singapore (SES) grants memberships to Seven foreign brokerage houses, allowing them to trade directly on the local market. * MAS raises the Singapore dollar lending limit for offshore banks to s$70 million from s$50 million.
Thailand	* The preferential tax rate for listed companies is removed. * The mutual fund industry is deregulated, and licenses are granted to seven new fund management companies. * Finance companies are authorized to act as selling agents for government bonds; to provide economic, financial, and investment information services; to advise companies seeking listing on the SET. * Commercial bank activities are expanded to include issuance, underwriting, and distribution of debt securities, trading of debt securities, and acting as supervisors and selling agents for mutual funds and securities registrars. * The Securities and Exchange Act (SEA) establishes the Securities and Exchange Commission (SEC) and defines rules, procedures, and supervision for each type of securities business, including private funds management. The SEA also allows limited and public

		companies to issue debt instruments with the approval of the SEC.
		* Celings on saving deposit rates and all lending rates are abolished.
		* A scripless clearing and settlement systme is introduced on the SET.
1993	Hong Kong	* The Hong Kong Monetary Authority released a seven-point recommendation as reference for lending banks after reviewing the report on the impact of subscription for new issues on Hong Kong's financial system.
	Japan	* Deregulation of smaller time deposits and money market certificates.
	Malaysia	* Bank Negara Malaysia bills are introduced.
		* The Securities Commission is established as the primary regulator and supervisor of securities markets.
		* The interest-free banking scheme is launched.
	Singapore	* SES launches options trading with the established of a scrip bank.
		* Common Effective Preferential Tariff (CEPT) scheme for the ASEAN free trade area is initiated.
	Thailand	* The Bangkok International Banking Facilities are established. Participants may provide three types of services: banking to nonresidents in foreign currencies and baht, banking to domestic residents in foreign currency only, and international financial and investment banking services.
		* The requirement that banks must hold a proportion of their deposits in government and other eligible bonds before opening new branches is abolished.
		* The Thai Rating and Information Service is established.
		* Each bank is required to declare a minimum lending rate, which is the rate on term credits to prime customers. Banks are also required to declare rates for general and large depositors.

1994	Hong Kong	* The Stamp Duty (Amendment) (No.2) Bill 1994 extended relief from stamp duty for stock borrowing and lending activities and raised the maximum borrowing period from 14 days to 12 months.
	Japan	* Deregulation of all deposits except demand deposits. * Partial deregulation of brokerage commission is effected.
	Korea	* The interest rate are deregulated for short-term deposits And loans eligible for the Bank of Korea rediscount. * The money market is expanded by the introduction of commercial papers with varying maturities and allowing short-term financing companies to deal in the foreign exchange business.
	Malaysia	* The two tier regulatory system allows larger commercial banks to engage in selected new activities (such as the operation of foreign currency accounts for exporters) and to conduct selected aspects of their operations under a more liberal regulatory environment.
	Thailand	* The Bond Dealers Club is founded as an officially sanctioned, but privately run, trading system operating under an established code of conduct and standardized dealing and settlement procedures.
1995	Australia	* Life Insurance Act 1995 comes into force.
	Malaysia	* The formula used by commercial banks and finance companies to calculate their base lending rates is revised to better reflect the underlying costs of funds; and institution may not lend at a rate above its base lending rate. * The Kuala Lumpur Options and Financial Futures Exchange commences trading in stock index futures.
	Thailand	* Weekly auctions of Bank of Thailand bonds are introduced. * The Bangkok Stock Dealing Center is established as an over-the-counter market to provide capital to nonlisted companies.

1996	Australia	* Wallis Inquiry into Australian financial system begins. * The rules to allow foreign domiciled banks to issue, in their own name, securities on the wholesale capital market are liberalized. Such securities must be in amounts of not less than A$ 500,000, and must indicate that they are being issued by a bank is not authorized under the Banking Act.
	Japan	* The amount of overseas deposits by residents, which are not restricted, was raised to 200 million Japanese yen.
	Korea	* The prescription of currency requirements applicable to foreign currencies were abolished. * Deposits overseas in won are allowed within the ceiling on the amount of won that can be carried out when traveling abroad. Also, residents were allowed to purchase and sell won, within the ceiling on the amount of won that can be carried out when traveling abroad, at both the domestic foreign exchange banks overseas and at branches and subsidiaries of foreign banks. * The limit on the amount of foreign currency that can be held abroad by general trading companies was raised to 50% with the maximum of $500 million of the trading value from 30% with the maximum of $300 million. * The ceilings on securities investments by residents were abolished. * The issuance of deferred recipts by foreign companies was allowed. * Stock index futures began to be tradedd on the existing stock exchange, and non residents' access to the market was allowed within a limit of 15%. * The ceiling on export advances for large enterprises was raised to 15% of the export value of the previous year from 10%.
	Malaysia	* The Malaysia Monetary Exchange commences trading in interest rate futures.

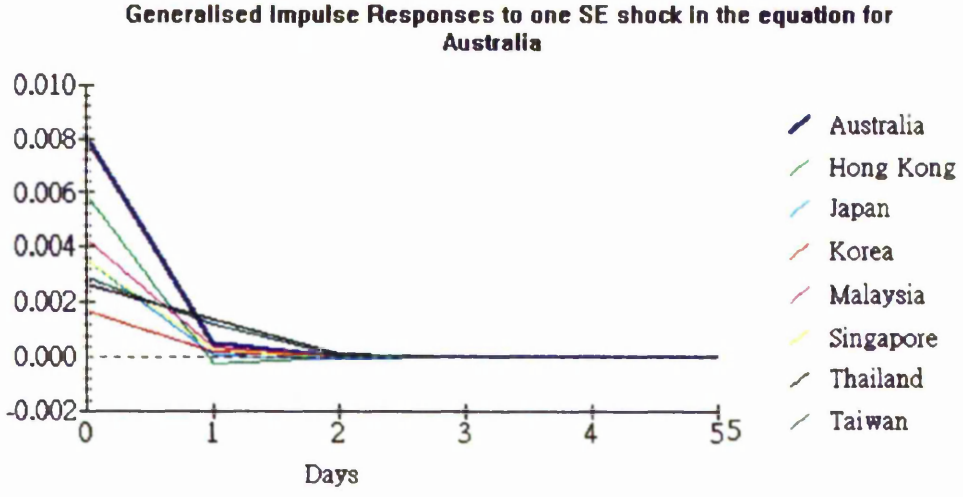
	* Short selling of selected stocks is permitted on the Kula Lumpur Stock Exchange. * The maximum overnight limit for export accounts was increased to $ 10 million from $5 million.
Singapore	* Nonresident firms were permitted to list on the stock market and to issue bonds in domestic currency, provided that 35% of their revenue is locally generated and their regional headquarters and senior management are based in Singapore.
Taiwan	* The ceiling on both the inward and outward foreign exchange remittances in the case of a local company from US$ 10 million to US$ 20 million per year. * Foreign investors are allowed to open their New Taiwan Dollar accounts for stock trading by authorizing a representative to open the account. * The ceiling on total foreign investments in any listed corporation's shares are raised from 15% to 20%. * The restriction that prevented on foreigners and overseas Chinese from lending sums of money to a local enterprise that exceeded three times the capital which they had invested in that enterprise are abolished. * Authorized foreign exchange banks were allowed to offer foreign currency derivatives in the OTC market as well as foreign currency equity (index) swaps. * The ceiling for investment in the shares of a listed company by a single foreign investor is raised to 10 % and by foreign investors as a whole is raised to 25%. * The ceiling on investment in the Taiwan stock market by each qualified foreign institutional investor from US$ 400 million to US$ 600 million.
Thailand	* Short-term offshore borrowing by financial institutions is subject to a 7 percent liquidity requirement.

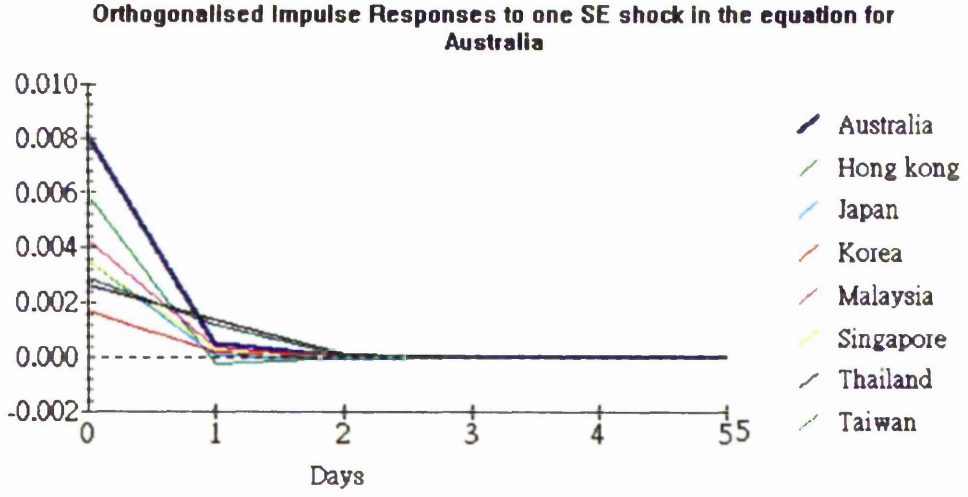
1997	Australia	* The blanket prohibition on a foreign takeover of any of the major banks was removed.
	Korea	* The total quantitative ceilings on the issuance of foreign-major banks was removed. currency-denominated securities abroad were raised. * The exchange rate of the won was allowed to float freely. * The debt limits on corporations making overseas direct investments, whereby 20% of investments exceeding $100 million had to be financed by a firm's own capital, were abolished.
	Malaysia	* Restrictions were imposed requiring banks to limit outstanding noncommercial-related ringgit offer side swap transactions to $2 million a foreign customer.
	Taiwan	* The regulation that set a ceiling on the foreign liabilities that could be held by authorized foreign exchange banks was abolished. * The ceilings on the inward and outward foreign exchange remittances in the case of a local company were raised from US$ 20 million to US$ 50 millionn per year. * The ceilings on the proportions of the listed shares in any local company that could be held by any single foreign institutional investor and by all foreign institutional investors together were raised from 10% and 25% to 15% and 30%, respectively.
	Thailand	*Temporary limits on outright forward transactions in baht with nonresidents and on the selling of baht spot to nonresidents were imposed. * The exchange rate of the baht was allowed to float freely, and a two-tier currency market was introduced. * The BOT introduced a series of measures to limit capital inflows. * The BOT limited transactions with nonresidents that could facilitate the build-up of baht positions in the offshore market, including direct loans, overdrafts, currency swaps, interest rate swaps, forward rate agreements, currency options, and interest rate options.

1998	Australia	* The open foreign exchange position limits on authorized foreign dealers was removed.
	Japan	* The prior notice requirement for outward investments by residents was abolished. However, the requirement will still apply to direct investments in a limited number of industries, such as the manufacture of arms and fisheries.
		* The prior notice requirement for portfolio investments by residents and nonresidents was abolished.
	Korea	* The regulations on usage of long-term loans with maturities of over five years that are brought into the country by foreign manufacturers were abolished.
	Thailand	* The two-tier foreign exchange market was unified.

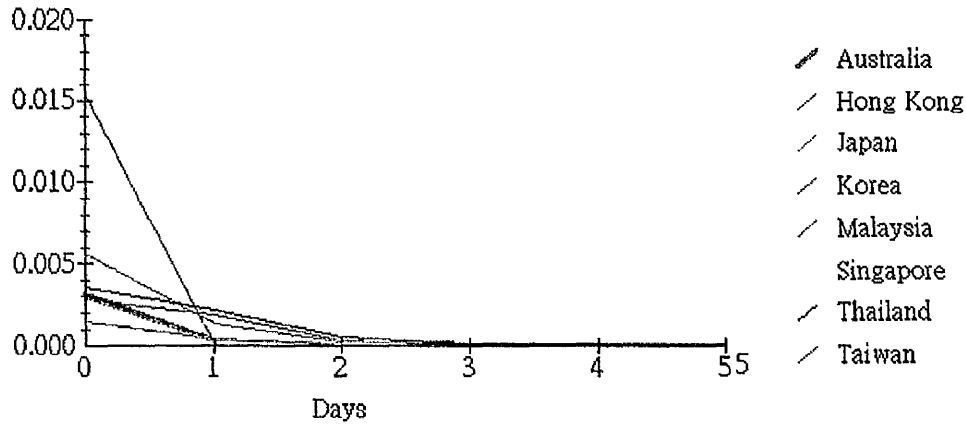
Sources: IMF's *Exchange Arrangements and Exchange Restrictions*, various issues; EIU's *Financial Foreign Operation: Asia*, various issues; and each country's Central Bank's *Annual Report*, various issues.

Appendix 2 Impulse Response (Generalised and Othogonalised) for sub-period 2: Results from Using MicroFit4.0

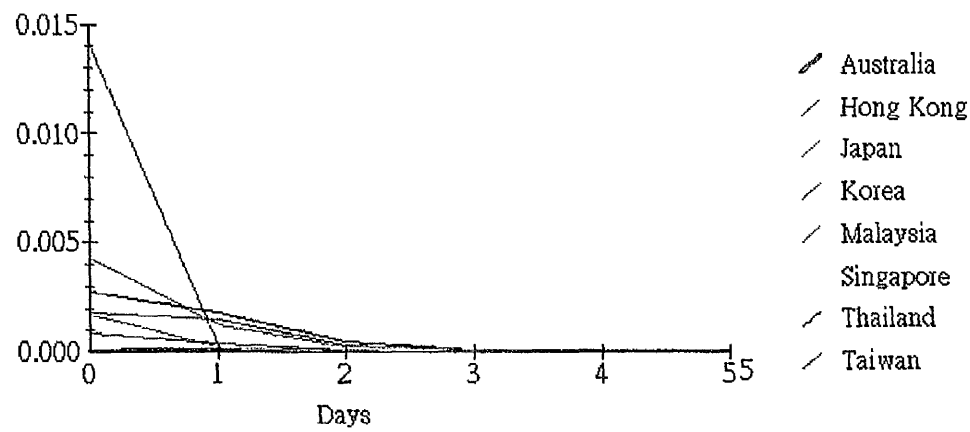




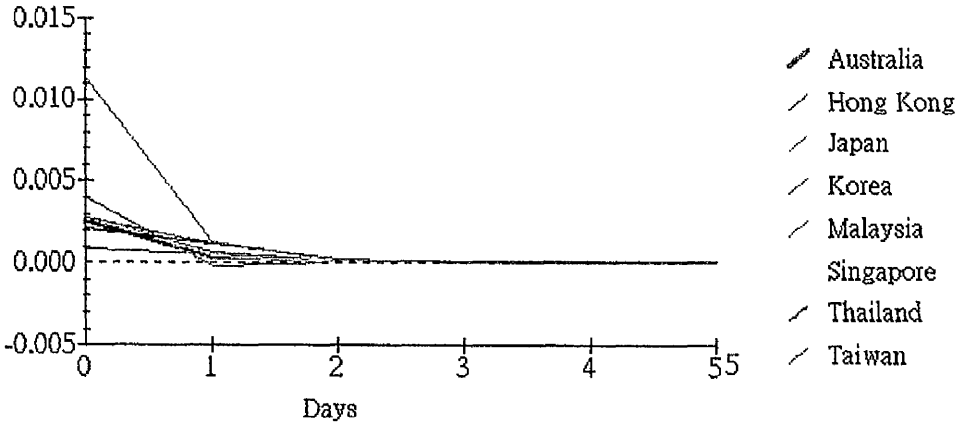
Generalised Impulse Responses to one SE shock in the equation for Hong Kong



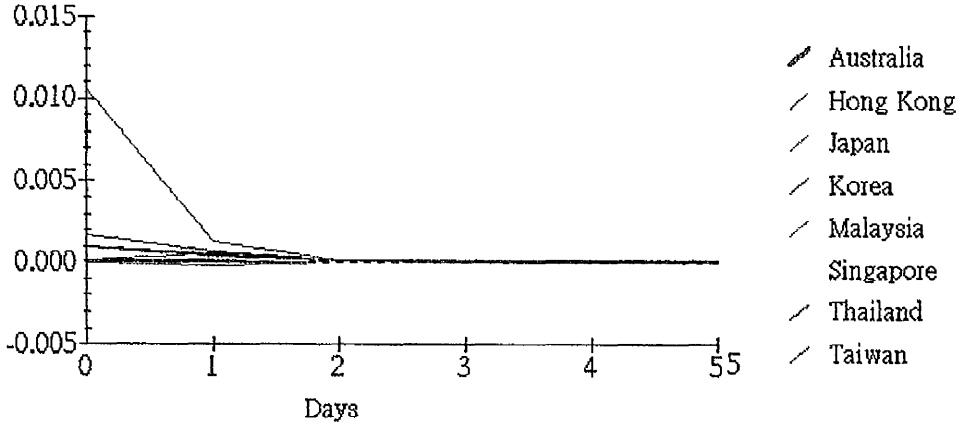
Orthogonalised Impulse Responses to one SE shock in the equation for Hong Kong



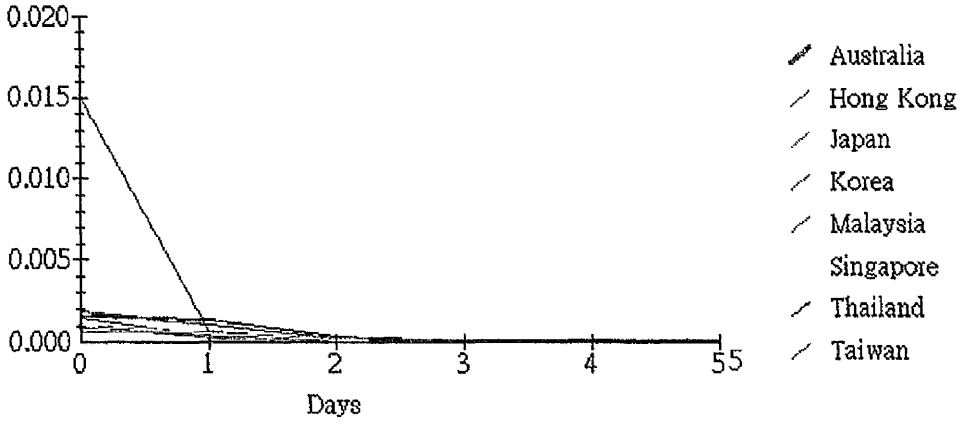
Generalised Impulse Responses to one SE shock in the equation for Japan



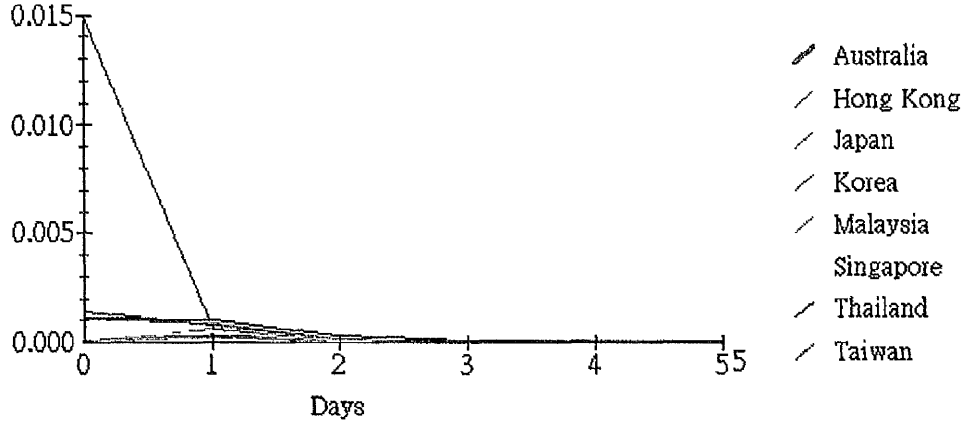
Orthogonalised Impulse Responses to one SE shock in the equation for Japan



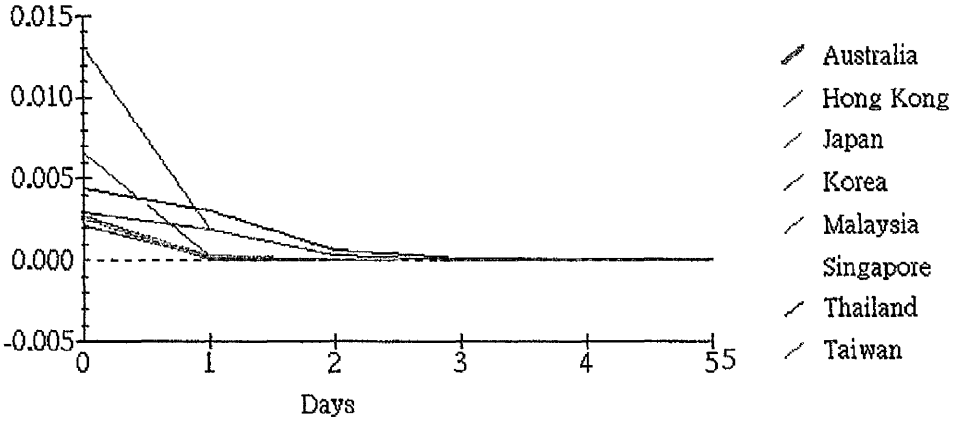
Generalised Impulse Responses to one SE shock in the equation for Korea



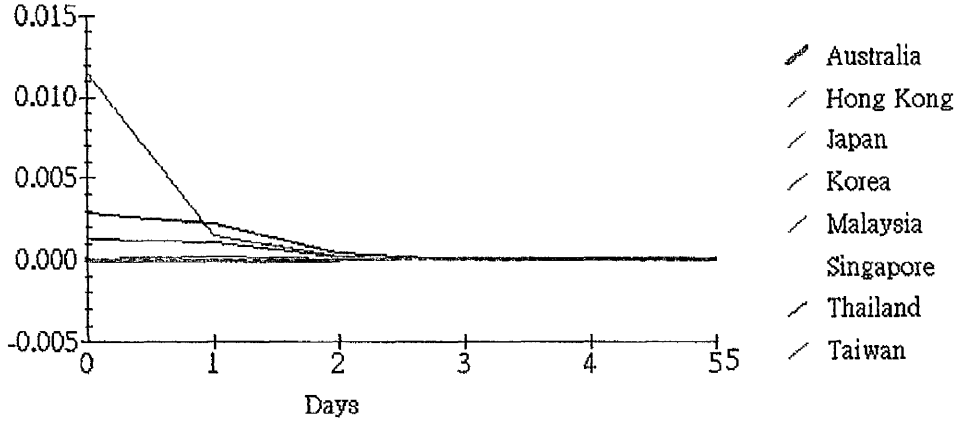
Orthogonalised Impulse Responses to one SE shock in the equation for Korea



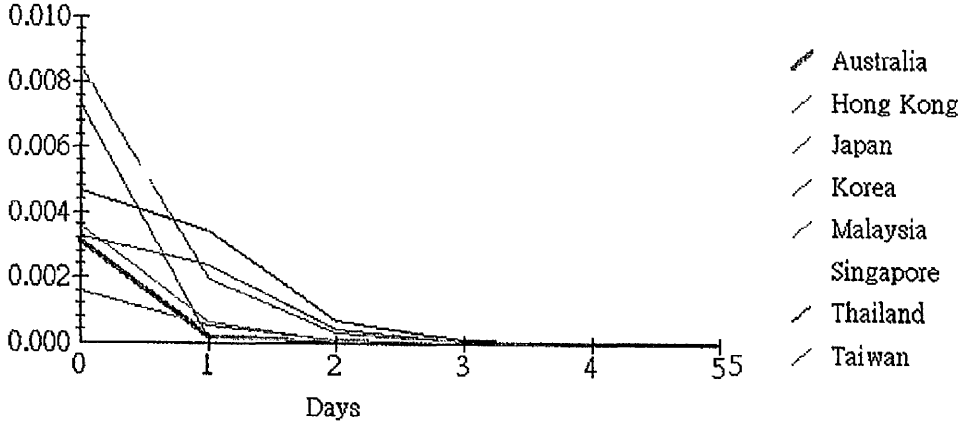
Generalised Impulse Responses to one SE shock in the equation for Malaysia



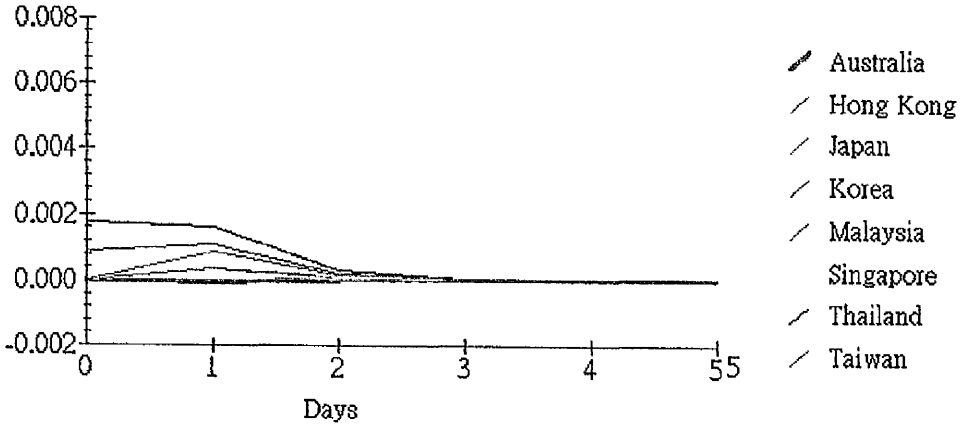
Orthogonalised Impulse Responses to one SE shock in the equation for Malaysia



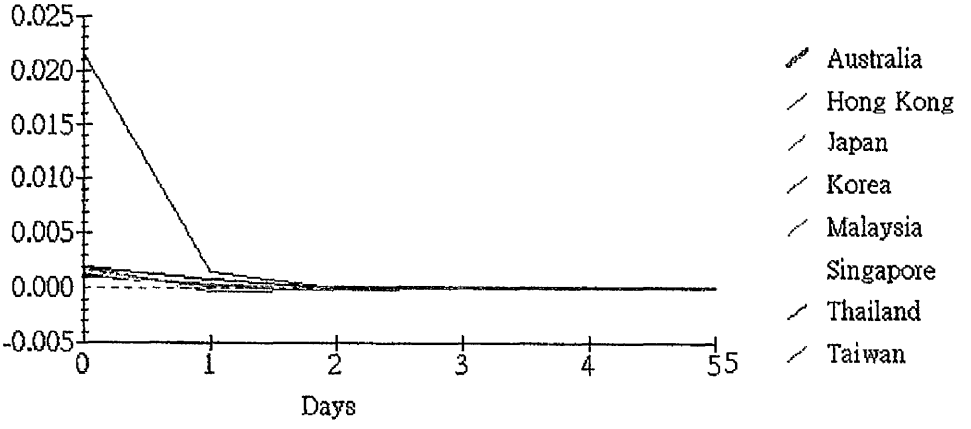
Generalised Impulse Responses to one SE shock in the equation for Singapore



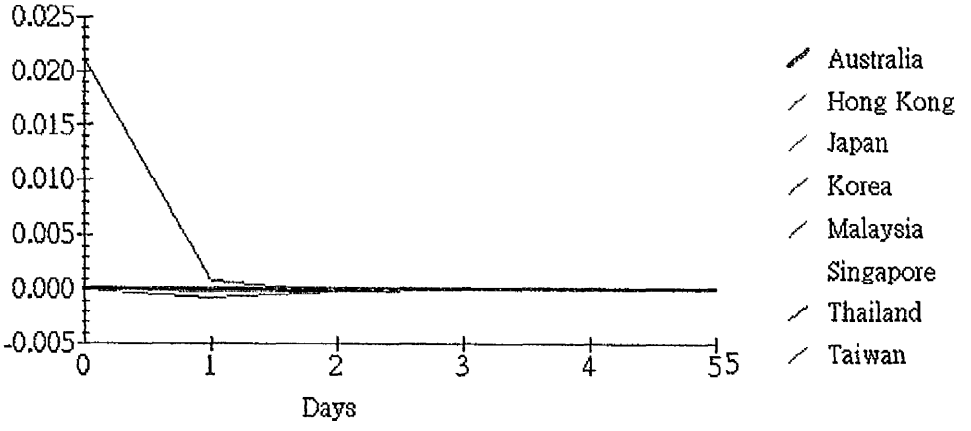
Orthogonalised Impulse Responses to one SE shock in the equation for Singapore



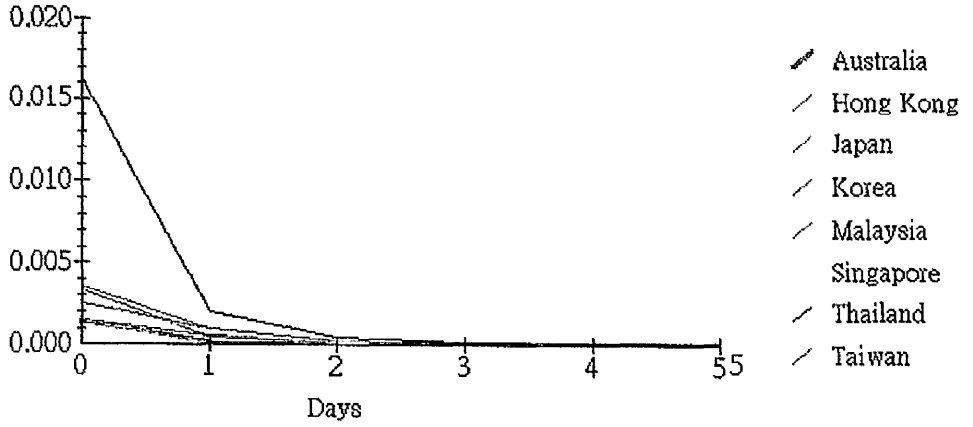
Generalised Impulse Responses to one SE shock in the equation for Taiwan



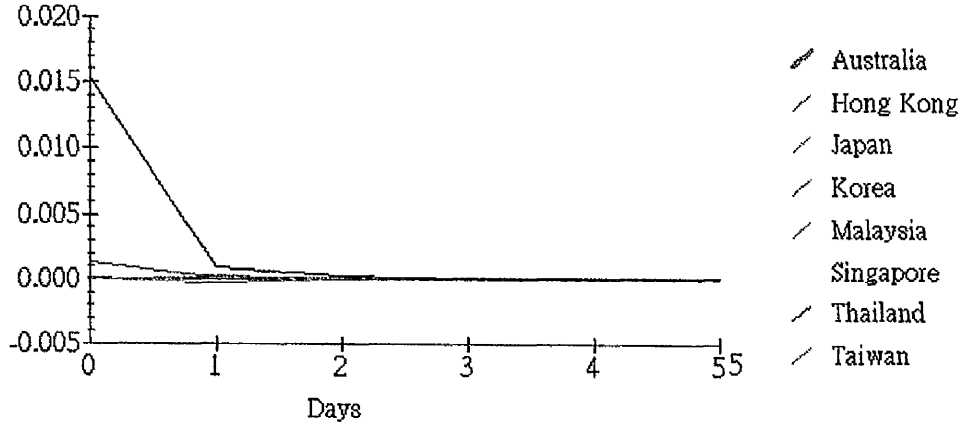
Orthogonalised Impulse Responses to one SE shock in the equation for Taiwan



Generalised Impulse Responses to one SE shock in the equation for Thailand



Orthogonalised Impulse Responses to one SE shock in the equation for Thailand



Bibliography

Aderhold, R., C. Cumming, and A. Harwood. 1988. "International Linkages among Equities Markets and the October 1987 Market Break." *FRBNY Quarterly Review.*

Aggarwal, R., R. Rao, and T. Hirake, 1986. "The Nature of Risk Adjusted Returns on the Tokyo Stock Exchange: P/E, Size and Seasonal Influences." Unpublished paper.

Agmon, T.. 1972. "The Relations Among Equity Markets: A Study of Share Price Co-Movements In the United States, United Kingdom, Germany, and Japan." *The Journal of Finance* XXVII.

Alexakis, P., and P. Petrakis. 1991. "Analysing Stock Market Behaviour in a Small Capital Market." *Journal of Banking and Finance* XV: 471-483.

Allen, D., and G. Macdonald. 1995. "The Long-Run Gains from International Equity Diversification: Australian Evidence from Cointegration Tests." *Applied Financial Economics*, 5: 33-42.

Andrade, I., A. Clare, and S. Thomas, 1991. "Cointegration and the Gains from International Diversification in Bonds and Equities." University of Southampton Discussion Paper in Economics and Econometries.

Annual Report. various issues. Bank of Japan.

Annual Report. various issues. Bank of Korea.

Annual Report. various issues. Bank Negara Malaysia.

Annual Report. various issues. Bank of Singapore.

Annual Report. various issues. Bank of Thailand.

Arshanspalli, B. and J. Doukas. 1993. "International Stock Market Linkages: Evidence from the Pre- and Post-October 1987 Period." *Journal of Banking and Finance* XVII: 193-208.

Artis, M. and M. Taylor. 1990. "International Financial Stability and the Regulation of Capital Flows." In The International Financial Regime, ed. G. Bird (Surrey University).

Aziz, Z.. 1989. "Development of the Capital Market in Malaysia." in Ng, B.. 1989. *The Development of Capital Markets in the SEACEN Countries*. Kuala Lumpur, Malaysia: The South East Asian Central Banks. 89-113.

Australian Economic Statistics. various issues. Reserve Bank of Australia.

Baily, W. and R. Stulz. 1990. "Benefits of International Diversification: the Case of Pacific Basin Stock Markets." Journal of Portfolio Management, summer, 7-16.

Balley, W., R. Stulz, and S. Yen. 1990. "Properites of Daily Stock Return from the Pacific Basin Stock Markets: Evidence and Implications." In *Pacific-Basin Capital Market Research* I. Amsterdam: Elsevier Science Publishers.

Balvers, R., T. Cosimano, and B. Mcdonald. 1990. "Predicting Stock Returns in an Efficient Market." *The Journal of Finance* XLV, 4.

Banerjee, A. and D. Hendry. 1992. "Testing for Integration and Cointegration: A Review." Oxford Bulletin of Economics and Statistics, LIV, 3: 225-256.

Banz, R.. 1981. "The Relationship Between Return and the Market Value of Common Stock." *Journal of Financial Economics* IX: 2-18.

Bascom, W.. 1994. *The Economics of Financial Reform in Developing Countries*. New York: The MacMillan Press Ltd.

Beltratti, A. and R. Shiller. 1993. "Actual and Warranted Relations Between Asset Prices." *Oxford Economic Papers* XLV: 387-402.

Bekaert, G.. 1995. "Market Integration and Investment Barriers in Emerging Equity Markets." *The World Bank Economic Review* IX, 1: 75-108.

Bekaert, G. and C. Havey. 1995. "Time-varying World Market Integration." Journal of Finance L, 2: 403-444.

Bekaert, G. and C. Havey. 1997. "Emerging Equity Market Volatility." Journal of Financial Economics, XLIII: 29-77.

Bennett, P. and J. Kelleher. 1988. "The International Transmission of Stock Price Disruption in October 1987." *FRBNY Quarterly Review.*

Berkman, N.. 1978. "On the Significance of Weekly Changes in M1." *Economic Review.* Federal Reserve Bank of Boston.

Bernanke, B., and A. Blinder. 1992. "The Federal Funds Rate and the Channels of Monetary Transmission." *American Economic Review* LXXXII: 901-921.

Bildersee, J., J. Chen, and C. Lee, 1990. "The International Price-earning Ratio Phenomenon: A Partial Explanation." Japan and the World Economy, II: 267-282.

Blackman, S., K. Holden, and W. Thomas. 1994. "Long-Term Relationships Between International Share Prices." *Applied Financial Economics* IV: 297-304.

Blanchard, O., C. Rhee, and L. Summers. 1993. "The Stock Market, Profit, and Investment." *The Quarterly Journal of Economics.*

Boyd, J. and B. Smith. 1996. "The Coevolution of the Real and Finnancial Sectors in the Growth Process." *The World Bank Economic Review* X, 2: 371-396.

Bosworth, B.. 1975. "The Stock Market and the Economy." in *Brookings Papers on Economic Activity* II.

Brainard, W., J. Shoven, and L. Weiss. 1980. "The Financial Valuation of the Return of Capital." in *Brookings Papers on Economic Activity* II: 453-502.

Brown, S. and T. Otsuki. 1998. "Macroeconomic factors and the Japanese equity market:

The CAPMD Project." In Elton, E. and M. Gruber, eds: *Japanese Capital Markets.* Harper and Row, New York.

Buckberg, E.. 1995. "Emerging Stock Markets and International Asset Pricing." *The World Bank Economic Review* IX, 1: 51-74.

Bulletin. various issues. Reserve Bank of Australia.

Campbell, J.. 1987. "Stock Returns and the Term Structure." *Jounal of Financial Economics* XVIII: 373-399.

Campbell, J. and Y. Hamao. 1992 "Predictable Stock Returns in the United States and Japan: A Study of Long Term Capital Market Integration" Journal of Finance, XLVII,1:43

Caporale, G., and N. Pittis. 1998. "Cointegration and Predictability of Asset Prices." Journal of International Money and Finance, 17: 441-453.

Cargill, T., H. Cheng, and M. Hutchison. 1986. "Financial Market Changes and Regulatory Reforms In Pacfific Basin Countries: An overview." In *Financial Policy and Reform In Pacific Basin Countries*, ed. H. S. Cheng. Lexington, Mass: Lexington Books.

CBC. *Annual Report.* various issues. Central Bank of China, Taiwan.

Chan, L., Y. Hamao, and J. Lakonishok. 1991. "Fundamentals and Stock Returns in Japan." Journal of Finance, XLVI, 5: 1739-1764.

Chan, K., A. Karolyi, R. Stulz. 1992." Global Financial Markets and the Risk Premium on U.S. Equity." *Journal of Financial Economics* XXXII: 137-167.

Chan, K. and P. Lai. 1990. "Unit Root and Cointegration Tests of World Stock Prices." *Pacific-Basin Capital Market Research* I. Amsterdam: Elsevier Science Publishers.

Chan, K., B. Gup, and M. Pan. 1992. "An empirical Analysis of Stock Price in Major Asian Markets and the United States." *The Financial Review* XXVII.

Charemza, W., and D. Deadman. 1992. *New Directions in Econometric Prictice.* Aldershot, Hants: Edward Elgar.

Chelley-Steeley, P. and E. Pentecost. 1994. "Stock Market Efficiency, the Small Firm Effect and Cointegration." *Applied Financial Economics*, 4: 405-411.

Chen, N., R. Roll, and S. Ross. 1986. "Economic Forces and the Stock Market." *Journal of Business* LVIIII, 3: 383-403.

Chen, N.. 1991. "Financial Investment Opportunities and the Macroeconomy." *Journal of Finance* XXXXVI: 529-554.

Cheng, H.. 1986. *Financial Policy and Reform in Pacific Basin Countries.* Canada: D. C. Heath and Company.

Cheng, H.. 1987. *Monetary Policy in Pacific Basin Countries.* New Yord: Kluwer Academic Publishers.

Cheung, Y. and Y. Ho. 1991. "The Intertemporal Stability of the Relationships Between the Asian Emerging Equity Markets and the Developed Equity Markets." *Journal of Business finance and Accounting* XVIII, 2: 235-254.

Cheung, Y. and S. Mak. 1992. "The International Transmission of Stock Market Fluctuation between the Developed Markets and the Asian-Pacific Markets." *Applied Financial Economic* II.

Cho, D., C. Eun, and L. Senbet. 1986. "International Arbitrage Pricing Theory: an Empirical Investigation." Journal of Finance, LXI: 313-330.

Cho, Y.. 1989. "Lessons of Financial Liberalization in Asia: A Comparative Study." *World Bank Discussion Paper* No. 50.

Choudhry, T.. 1994. "Stochastic Trends and Stock Prices: an International Inquiry." Applied Financial Economics, 4: 383-390.

Choudhry, T.. 1996. "Interdependence of Stock Markets: Evidence from Europe during the 1920s and 1930s." Applied Financial Economics, 6: 243-249.

Chowdhury, A.. 1994. "Stock Market Interdependencies: Evidence from the Asian NIEs." *Jurnal of Macroeconoics* XVI, 4.

Chuppe, T., H. Haworth, and M. Watkins. 1989. "Global Finance: Causes, Consequences, and Prospects for the Future." Global Finance Journal, I: 1-20.

Claessens. S., S. Dasgupta, and J. Glen. 1995 "Return Behaviour in Emerging Stock Markets." *The World Bank Economic Review* IX, 1: 131-152.

Claessens, S.. 1995. "The Emergence of Equity Investment in Developing Countries: Overview." *The World Bank Economic Review* IX, 1: 1-18.

Coakley, J. and A. Fuertes. 1997. "Short Run PPP Dynamics in a VEC Framework." Discussion Paper in Economics No 11/97, Birkbeck College, University of London.

Cole, D., and H. Patrick. 1986. "Financial Development in the Pacific Basin Market Economies." In *Pacific Growth and Financial Interdependence*, ed. A. H. H. Tan and B. Kapur. Winchester, Mass: Allen and Unwin.

Cooley, T. and S. LeRoy. 1985. "Atheoretical Macroeconometrics: A Critique." *Journal of Monetary Economics* XVI: 283-308.

Corhay, A., A. Rad, and J. Urbin. 1993. "Common Stochastic Trends in European Stock Markets." Economics Letters, XLII: 385-390.

Corhay, A., A. Rad, and J. Urbain. 1995. "Long Run Behaviour of Pacific-Basin Stock Prices." Applied Financial Economics, 5: 11-18.

Cornell, B.. 1983. "The Money Supply Announcements Puzzle: Review and Interpretation." *American Economic Review* LXXIII: 644-657.

Cramer, J.. 1986. "The Volume of Transactions and the Circulation of Money in the United States, 1950-1979." *Journal of Business and Economic Statistics*: 225-232.

Crowder, W.. 1996. "A Note on Cointegration and International Capital Market Efficiency: A reply." Journal of International Money Finance, XIII: 661-664.

De. Santis, G. and S. Imrohoroglu. 1997. "Stock Returns and Volatility in Emerging Financial Markets." Journal of International Money and Finance, XVI, 4: 561-579.

Doan, T.. 1992. *RATS: User's Manual.* Evanston, IL, USA: Estima Publication.

Dolado, J., T. Jenkinson, and S. Sosvilla-Rivero. 1990. "Cointegration and Unit Roots: a Survey." Journal of Economic Surveys, IV, 3: 249-273.

Dougherty C.. 1992. *Introduction to Econometrics.* Oxford: Oxford University Press,Inc..

Dumas, B.. 1994. "Some Models of the International Capital Market" *European Economic Review* XXXVIII: 923-931.

Duriyaprapan, C.. 1989. "Development of the Capital Market in Thailand." in Ng, B. 1989. *The Development of Capital Markets in the SEACEN Countries.* Kuala Lumpur, Malaysia: The South East Asian Central Banks.

Dwyer, G. and M. Wallage. 1992. "Cointegation and Market Efficiency." *Journal of International Money and Finance* XI: 318-327.

Dwyer G., and R. Hafer. 1988. "Are National Stock Markets Linked?" *Economic Review.* Federal Reserve Bank of St. Louis.

Ecludardo Fernandez-Arias and P. Montiel. 1995. "The Surge in Capital Inflows to Developing Countries." *NBER.* No.4792.

EIU. *Country Report: Australia.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Hong Kong.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Japan.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Korea.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Malaysia.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Singapore.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Taiwan.* Various Issues. The Economist Intelligence Unit.

EIU. *Country Report: Thailand.* Various Issues. The Economist Intelligence Unit.

EIU. *Financial Foreign Operation: Asia.* 1997 and various issues. The Economist Intelligence Unit.

EIU. "Financing Operation in Australia." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Hong Kong." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Japan." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Korea." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Malaysia." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Singapore." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Taiwan." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

EIU. "Financing Operation in Thailand." 1997 and various issues. in *Financial Foreign Operation: Asia.* The Economist Intelligence Unit.

Elton, E., and M. Gruber, 1989. "Expectational Data and Japan Stock Prices." Japan and the World Economy, I: 391-410.

Enders, W.. 1995. "Applied Econometric Time Series." New York: John Wiley & Sons, Inc...

Engle, R. and C. Granger. 1987. "Co-integration and Error Correction: Representation, Estimation and Testing." *Econometrica* IV: 251-276.

Eun, C. and S. Shim. 1989. "International Transmission of Stock Market Movements." *Journal of Financial and Quantitative Analysis* XXIV, 1: 241-256.

Fackler, J. and J. Rpgers.. 1993. "An Empirical Open-Economy Macro Model with Credit." *Journal of Macroeconomics* XV, 2: 203-224.

FactBook. 1997 and Various Issues. Australia: The Australian Stock Exchange.

FactBook. 1997 and Various Issues. Hong Kong: The Stock Exchange of Hong Kong.

FactBook. 1997 and Various Issues. Japan: The Tokyo Stock Exchange.

FactBook. 1997 and Various Issues. Korea: The Korea Stock Exchange.

FactBook. 1997 and Various Issues. Malaysia: The Kuala Lumpur Stock Exchange.

FactBook. 1997 and Various Issues. Singapore: The Singapore Stock Exchange.

FactBook. 1997 and Various Issues. Taiwan: The Taiwan Stock Exchange.

FactBook. 1997 and Various Issues. Thailand: The Thailand Stock Exchange.

Financial and Capital Markets in Asia. 1991. Foundation for Advanced Information and Research. Japan (FAIR).

Fama, E.. 1976. *Foundations of Finance.* NY: Basic Books Inc.

Fama, E.. 1981. "Stock Returns, Real Activity, Inflation, and Money." *American Economic Review* LXXI: 545-65.

Fama, E., and M. Gibbons. 1982. "Inflation, Real Activity, and Capital Investment." *Journal of Monetary Economics* VIII: 297-323.

Fama, E., and K. French. 1989. "Business Conditios and Expected Returns on Stock and Bonds." *Journal of Financial Economics*, XXV: 23-49.

Fama, E., and K. French. 1988. "Dividend Yields and Expected Stock Returns." *Journal of Financial Economics* XXII: 3-25.

Fama, E.. 1990. "Stock Returns, Expected Returns, and Real Activity." *The Journal of Finance* XXXV, 4.

Fama, E.. 1990. "Efficient Capital Markets, II." Unpublished paper, University of Chicago.

Feldman, R. and M. Kumar. 1995. "Emerging Equity Markets: Growth, Benefits, ands Policy Concerns." *The World Bank Economic Review* X, 2: 181-200.

Finnerty, J., and T. Schneeweis. 1979. "The Comovement of International Asset Returns." *Journal of International Business Studies* X: 66-78.

Fischer, K. and A. Palasvirta. 1990. "High Road to a Global Marketplace: The International Transmission of Stock Market Fluctuations." *The Financial Review* XX, 3: 371-394.

Fortune, P.. 1991. "Stock Market Efficiency: an Autopsy?" New England Economic Review, Federal Reserve Bank of Boston, 17-40.

Frankel, J.. 1994. *The Internationalization of Equity Markets.* The National Bureau of Economic Research. Chicago: The University of Chicago Press.

Fraser, P., C. Helliar, and D. Power. 1994. "An Empirical Investigation of Convergence among European Equity Markets." Applied Financial Economics, 4: 149-157.

Freris, A.. 1991. *The Financial Market of Hong Kong.* New York: Routledge.

Friedman, M.. 1988. "Money and The Stock Market." *Journal of Political Economy*: 221-244.

Fung, H. and C. Lie. 1990. "Stock Market and Economic Activites: A Causal Analysis." In *Pacific-Basin Capital Markets Research* II. Amsterdam: Elsevier Science Publishers.

Furstenberg, G., and B. Jeon. 1989. "International Stock Price Movements: Links and Messages." *Brookings Papers on Economic Activity* I: 125-180.

Garcia, R. and E. Ghysels. 1998. "Structural Change and Asset Pricing in Emerging Markets." Journal of International Money and Finance, 17: 455-473.

Geske, R., and R. Roll. 1983. "The Fiscal and Monetary Linkage Between Stock Returns and Inflation." *Journal of Finance* XXXVIII: 1-33.

Gilles, C.. 1989. "Charges as Equilibrium Prices and Asset Bubbles." *Journal of Mathematical Economics* XVIII: 155-67.

Gilles, C., and S. LeRoy. 1992. "Bubbles and Charges." *International Economic Review* XXXIII.

Goldstein, M.. 1995. "Coping With too Much of a Good Thing" *Working Paper.* IMF WP/93/95.

Greenwood, J.. 1986. "Financial Liberalization in Seven East Asian Economies." In *Financial Innovation and Monetary POlicy: Asia and the West.* Ed. Y Suzuki and H. Yomo. Tokyo: University of Tokyo press.

Granger, C.. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods." *Econometrica* XXXVII: 424-438.

Granger, C., and O. Morgenstern. 1970. *Predictability of Stock Market Prices.* New York: Heath Lexington Books.

Granger, C.. 1986. "Developments in the Study of Cointegrated Economic Variables." *Oxford Bullentin of Economics and Statistics*: 213-228.

Greiche, M. and D. Galloway. 1996. *The GT Guild to World Equity Markets.* London: Euromoney Publication PLC..

Grossman, S.. 1990. "Introduction to NBER Symposium on the October 1987 Crash." *The Review of Financial Studies* III, 1: 1-3.

Grubel, H.. 1968. "International Diversified Portfolios: Welfare Gains and Capital Flows." *American Economic Review* LVIII.

Gultekin, M., N. Gultekin, and A. Penati. 1989. "Capital Controls and International Capital Market Segmentation: The Evidence from the Japanese and American Stock Markets." *The Journal of Finance* XXXIIII: 849-868.

Gupta, K.. 1997. *Experience with Financial Liberalization.* New York: Kluwer Academic Publishers.

Guttman, W.. 1988. *The Pacific-Asian Capital Markets and Regional Financial Co-operation.* OECD Development Centre.

Hafer, R. and R. Sheehan. 1991. "Policy Inference Using VAR Models." *Economic Inquiry* XXIX: 44-52.

Haggard, S. and C. Lee. 1995. *Financial Systems and Economic Policy in Developing countries.* Cornell University Press.

Hall, S. and Henry S.. 1988. *Macroeconomic Modelling.* Amsterdam: North Holland.

Hall, S.. 1989. "Maximum Likelihood Estimator of Cointegrating Vectors: An Example of the Johansen Procedure." *Mimeo*, Bank of England.

Hamao, Y. 1998. "An Empirical Examination of the Arbitrage Pricing Theory: Using Japanese Data." In Japan and the World Economy, I: 45-61.

Hamilton, J.. 1989. "A New Approach To the Economic Analysis Of Nonstationary Time series and The Business Cycle." *Econometrica* LVII, 2: 357-384.

Hamilton, J.. 1994. *Time Series Analysis.* New York: Princeton / Wiley.

Hardouvelis, G.. 1987. "Macroeconomic Information and Stock Prices." *Journal of Economics and Business* XXXIX: 131-140.

Harris, T., and T. Opler. 1990. "Stock Market Returns and Real Activity." *Working Paper*, University of California, Los Angeles.

Harvey, C.. 1991. "The World Price of Covariance Risk." Journal of Finance, XLVI, 1: 111-156.

Hilliard, J.. 1979. "The Relationship Between Equity Indices on World Exchanges." *The Journal of Finance* XXXIIII.

Ho, R., R. Scott, and K. Wong. 1991. *The Hong Kong Financial System*. Oxford: Oxford University Press.

Howell, M.. 1994. *Investing in Emerging Markets*. London: Euromoney Publications.

Huang, R. and W. Kracaw. 1984. "Stock Market Returns and Real Activity: A Note." *The Journal of Finance* XXXIX, 1: 267-273.

Hugh, P. and C. Yung. 1994. *The financial Development of Japan, Korea, and Taiwan.* Oxford: Oxford University Press.

IFR. *World Stock and Commodity Exchanges*. 1995. The Euroclear IFR.

IFC. *Emerging Stock Markets: FactBook.* various issues: 1993, 1994, 1995, 1996, 1997. International Finance Corporation Publications.

IMF. "Exchange Arrangements and Exchange Restrictions: Australia." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Hong Kong." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Japan." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Korea." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Malaysia." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Singapore." various issues. *Annual Report*. IMF.

IMF. "Exchange Arrangements and Exchange Restrictions: Thailand." various issues. *Annual Report*. IMF.

IMF. *International Capital Markets: Developments, Prospects, and Policy Issues*. various Issues. International Monetary Fund.

IMF. *Trends in Developing Countries*, various Issues. International Monetary Fund.

IMF. *Balance of Payments Statistics Yearbook*. various Issues. International Monetary Fund.

IMF. *International Financial Statistics*. various Issues. International Monetary Fund.

Ito, T., and A. Krueger. 1994. *Macroeconomic Linkage*. The National Bureau of Economic Research.

Jaffe, J., and R. Westerfield, 1985. "Patterns in Japanese Common Stock Returns: Day of the Week and Turn of the Year Effects." Journal of Financial and Quantitative Analysis, XX: 261-272.

Jensen, G., and J. Mercer, and R. Johnson. 1996. "Business Conditions, Monetary Policy, and Expectedd Security Returns." *Journal of Financial Economics* XXXX: 213-237.

Jensen, G., and R. Johnson. 1995. "Discount Rate Changes and Security Returns in the U.S., 1962-1991." *Journal of Banking and Finance* XIX: 79-95.

Jeon, B., and G. Furstenberg. 1990. "Growing International Co-movement in Stock Price Indexes." *Quarterly Review of Economics and Business*. XXX, 3: 15-30.

Jeon, B. and T. Chiang. 1991. "A system of Stock Prices in World Stock Exchanges: common Stochastic Trends for 1975 – 1990?" Journal of Economics and Business, XLIII: 329-338.

Johansen, S.. 1988. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control* XII: 231-254.

Johansen, S. and K. Juselius. 1990. "Maximum Likelihood Estimation and Inference on Cointegration - with Applications to the Demand for Money." *Oxford Bulletin of Economics and Statistics* LII: 169-210.

JP Morgan. *World Financial Market.* various issues.

Kaneko, T. and B. Lee. 1995. "Relative Importance of Economic Factors in the U.S. and Japanese Stock Markets." Journal of the Japanese and International Economics, IX: 290-307.

Kasa, K.. 1992. "Common Stochastic Trends in International Stock Markets." Journal of Monetary Economics, XXIX: 95-124.

Kasa, K.. 1992. "Common Stochastic Trends in International Stock Markets." *Journal of Monetary Economics* XXIX: 95-124.

Kato, K., and J. Schallheim, 1985. "Seasonal and Size Anomalies in the Japanese Stock Market," Journal of Financial and Quantitative Analysis, XX: 243-260.

Kato, K., W. Ziemba, and S. Schwartz, 1990. "Day of the Week Effects in Japanese Stocks." In Elton, E. and M. Gruber, eds: *Japanese Capital Markets*. Harper and Row, New York.

Kaul, G.. 1987. "Stock Returns and Inflation: The Role of the Monetary Sector." *Journal of Financial Economics* XVIII: 253-276.

Khoury, S., B. Dodin, and H. Takada. 1987. "Multiple Time-Series Analysis of National Stock Markets and Their Structure: Some Implications." In *Recent Developments in International Banking and Finance* I: 169-186.

King, M. and S. Wadhwani. 1990. "Transmission of Volatility Between Stock Markets." *The Review of Financial Studies* III, 1: 5-33.

Koch, P. and T. Koch. 1991. "Evolution in Dynamic Linkages Across Daily National Stock Indexes." Journal of International Money and Finance, X: 231-251.

Kohlhagen, S.. 1983. "Overlapping National Investment Poptfolios: Evidence and Implications of International Integration of Secondary Markets for Financial Assets." In *Research in international Business and Finance* III: 113-137.

Ko, K. and S. Lee. 1991. "A Comparative Analysis of the Daily Behavior of Stock Returns: Japan, the US, and the Asian NICs." *Journal of Business Finance and Accounting* XVIII.

Korajczyk, R.. 1996. "A Measure of Stock Market Integration for Developed and Emerging Markets." *The World Bank Economic Review* X, 2: 267-290.

Korea Institute of Finance. 1997. *KIF Studies in Financial and Monetary Issues.* Korea Institute of FInance.

Korea Bank. 1990. *Financial System in Korea.* The Bank of Korea.

Kryzanowski, L., and M. To. 1983. "General Factor Models and the Structure of Security Returns." *Journal of Financial and Quantitative Analysis* XVIII, 1: 31-52.

Kuo, C.. 1991. *International Captial Movements and the Developing World.* New York: Praeger Publishers.

Lee, I., R. Pettit, and M. Swankoski. 1990. "Daily Return Relationships Among Asian Stock Markes." *Journal of Business Finance and Accounting* XVII.

Lee, S.. 1990. *Money and Finance in the Economic Development of Taiwan.* New York: The MacMillan Press Ltd..

Lee, S. and K. Ohk. 1991. "Time-Varying Volatilities and Stock Market Returns: International Evidence." In *Pacific-Basin Capital Market Research* II. Amsterdam: Elsevier Science Publishers.

Lee, B. and B. Jeon. 1995. "Common Stochastic Trends and Predictability of International Stock Prices." Journal of the Japanese and International Economics, 9: 245-277.

LeRoy, R.. 1989. "Efficient Capital Markets and Martingales." Journal of Economics Literature, XXVII: 1583-1621.

Lessard, D.. 1973. "International Portfolio Diversification: A multivariate Analysis For A Group of latin American Countries." *Journal of Finance* XXVIII: 619-630.

Lessard, D.. 1974. "World, National, and Industry Factors in Equity Returns." *The Journal of Finance* XXIX, 2: 379-398.

Levich, R..1985. "Empirical Studies of Exchange Rates: Price Behavior, Exchange Rate Determination, and Market Efficiency." In: Jones, R. W., Kenen, P.B. (Eds), Handbook of International Economics, Vol 2, Elsevier Science, New York, pp.979-1040.

Levine, R.. 1991. "Stock Markets, Growth, and Tax Policy." *The Journal of Finance* XXXXVI: 1445-1459.

Levine, R., and S. Zervos. 1996. "Stock Market Development and Long-Run Growth." *The World Bank Economic Review* X, 2: 323-340.

Levy, H., and M. Sarnat. 1970. "International Diversification of Investment portfolios." *American Economic Review* LX: 668-75.

Lin, J., M. Xia, and R. Eldridge. 1989. "Linkages of Financial Markets: Internationalization versus Globalization." International Jjournal of Development Banking, VII: 3-12.

Lin, W., R. Enlge, and T. Ito. 1994. "Do Bulls and Bears Move across Borders? International Transmission of Stock Returns and Volatility." *The Review of Financial Studies* VII, 3: 507-538.

Lorie, J., P. Dodd, and M. Kimpton. 1985. *The Stock Market: Theories and Evidence.* New York: Richard D. Irwin, Inc.

Lucas, R.. 1972. "Expectations and Neutrality of Money." *Journal of Economic Theory*: 103-124.

Ma, C.. 1990. "Financial Market Integration and Cointegration Tests." In *Pacific-Basin Capital Market Research* I. Amsterdam: Elsevier Science Publishers.

Madyra, J.. 1992. "Financial Markets and Institutions." West Publishing Company, New York.

Makridakis, S., and S. Wheelwright. 1974. "An analysis of the Interrelationships Among the Major World Stock Exchanges." *Journal of Business Finance and Accounting* I: 195-215.

Marsh, T. and R. Merton. 1989. "Dividend Variability and Variance Bound Tests for the Rationality of Stock Prices." Amercian Economic Review, 483-498.

Masih, A. and R. Masih, 1995. "Investigating the Robustness of Tests of the Market Efficiency Hypothesis: Contributions From Cointegration Techniques on the Canadian Floating Dollar." Applied Financial Economics, V: 139-150.

Masih, A. and R. Masih. 1996. "Common Stochastic Trends, Multivariate Market Efficiency and the Temporal Causal Dynamics in a System of Daily Spot Exchange Rates." Applied Financial Economics, 6: 495-504.

Mathur, I. and V. Subrahmanyam. 1990. "Interdependencies among the Nordic and U.S. Stock Markets." *Scand. J. of Economics* LXXXXII, 4: 587-597.

McKinnon, R.. 1991. *The Order of Economic Liberalization.* New York: The Johns Hopkins University Press.

McMillin, D.. 1991. "The Velocity of M1 in the 1980s: Evidence from a Multivariate Time Series Model." *Southern Economic Journal* LVII: 634-48.

McQueen, G. and V. Roley. 1993. "Stock Prices, News, and Business Conditions." *The Review of Financial Studies* VI, 3: 683-707.

Meric, I., and G. Meric. 1997. "Global Co-movementa of Stock Markets Before and After 1987 Crash." In *The Global Structure of Financial Markets: An Overview.* ed. by Ghosh, D. and E. Ortiz.

Moore, D., D. Lyell, D. Wheller, J. Tongzon, and R. Crane. 1988. *Financial Institutions and Markets.* Australia: Serendip Publications.

Muscatelli, V.. 1990. "Exogeneity, Cointegration and the Demand for Money in Italy." *Discussion Papers in Economics*, No.9004, University of Glasgow.

Nakamura, T. and N. Terada, 1984. "The Size Effect and Seasonality in the Japanese Stock Market, Working Paper.

Nagatomi, Y. 1991. *Financial and Capital Markets in Asia.* Foundation for Advanced Information and Research, Japan (FAIR).

Ng, B. 1989. *The Development of Capital Markets in the SEACEN Countries.* The South East Asian Central Banks. Kuala Lumpur, Malaysia.

Ng, V., R. Chang, and R. Chou. 1991. "An Examination of the Behavior of Pacific-Basin Stock Market Volatility." In *Pacific-Basin Capital Markets Research* II. Amsterdam: Elsevier Science Publishers.

Ortiz, E.. 1997. "Globalization of Business and Finance and Emerging Capital Markets." In *The Global Structure of Financial Markets: An Overview.* ed. by Ghosh, D. and E. Ortiz. Pagan, A.. 1987. "Three Econometric Methodologies: A Critical Appraisal." *Journal of Economic Surveys* I: 3-24.

Panton, D., V. Lessig, and M. Joy. 1976. "Co-movement of International Equity Markets: A Taxonomic Approach." *Journal of Financial and Quantitative Analysis* XI: 415-432.

Park, H. 1991. "Market Efficiency, speculative Behaviour of Investors and the Volatility of Equilibrium Prices." In *Pacific-Basin Capital Markets Research* II. Amsterdam: Elsevier Science Publishers.

Park, J. and A. Fatemi. 1993. "The Linkage Between the Equity Markets of Pacific-Basin Countries and those of the US, UK and Japan: A Vector Autoregression Analysis." Global Finance Journal.

Pearce, D., and V. Roley. 1983. "The Reaction of Stock Prices to Unanticipated Changes in Money: A Note." *Journal of Finance* XXXVIII: 1323-33.

Pearce, D., and V. Roley. 1985. "Stock Prices and Economic News." *Journal of Business* LVIII, 1: 49-68.

Pesaran, M. and Y. Shin. 1997. "Generalized Impulse Response Analysis in Linear Multivaiate Models." Unpublished manuscript, Cambridge University.

Pesaran, M. and B. Pesaran. 1997. "Working with MiccroFit 4.0, Interactive Econometric Analysis." Oxford University Press.

Phillips, P., and P. Perron. 1988. "Testing for a Unit Root in Time Series Regression" *Biometrica* LXXV: 335-46.

Pindyck, R. and J. Rotemberg. 1993. "The Comovement of Stock Prices." *The Quarterly Journal of Economics*: 1073-1103.

Price, M.. 1994. *Emerging Stock Markets.* London: MaGraw-Hill Inc..

Remolona, E.. 1991. "Do International Reactions of Stock and Bond Makrets Reflect Macroeconomic Fundamentals?" *FRBNY Quarterly Review*: 1-13.

Renshaw, G. T.. 1989. *Market Liberalization, Equity and development.* International Labour Organization.

Rhee, G., P. Chang, and A. Ageloff. 1990. "An Overview of Equity Markets in Padific-Basin Countries." In *Pacfic-Basin Capital Markets Research* I. Amsterdam: Elsevier Science Publishers.

Richards, A.. 1995. "Comovements in National Stock Market Returns: Evidence of predictability, but not Cointegration." *Journal of Monetary Economics* XXXVI: 631-654.

Richards, A., 1996. "Co-movements in National Stock Market Returns: Evidence of Predictability but not Cointegration." International Monetary Fund Working Paper: wp/96/28.

Ripley, D.. 1973. "Systematic Elements in the Linkage of National Stock Market Indices." *The Review of Economics and Statistics*: 356-361.

Ross, S.. 1987. "The Interrelations of Finance and Economics: Theoretical Perspectives." American Economic Reviews, LXXVII: 29-34.

Poterba, J. and L. Summers. 1988. "Mean Reversion in Stock Prices." Journal of Financial Economics, XXII: 27-59.

Rowley, A.. 1987. *Asian Stock Markets: The Inside Story.* London: Dow Jones-Irwin.

Runkle, D.. 1987. "Vector Autoregressions and Reality." *Journal of Business & Economic Statistics* V, 4: 437-454.

Santiprabhob, V.. 1992. "On the Reverse Order of Financial Liberalization: East Asian Implications from a Political Economy Model." *Economic Review.* Federal Reserve Bank of San Francisco.

Sargent, T., and N. Wallace. 1975. "Rational Expectatio, the Optimal Monetary Instrument and the Optimal Money Supply Rule" *Journal of Polical and Economy*: 265-293.

Scholhammer, H., and O. Sand. 1985. "The Interdependence Among the Stock Markets of Major European Countries and the United States: An Empirical Investigation of Interrelationships Among National Stock Price Movements." *Management International Review* XXV: 17-26.

Schollhammer, H., and O. Sand. 1987. "Lead-Lag Relationships among National Equity Markets: An Empirical Investigation." In *Recent Developments in International Banking and Finance* I: 149-168. ed. by S. khoury, and A. Ghosh.

Schwert, G.. 1990. "Stock Returns and Real Activity: A Century of Evidence." *The Journal of Finance* XXXXV, 4: 1237-1258.

Serletis, A. and M. Sondergard. 1996. "Permanent and Temporary Components of Canadian Stock Prices." Applied Financial Economics, 6: 259-269.

Sewell, S., S. Stansell, I. Lee, and S. Below. 1996. "Using Chaos measures to examine International Capital Market Integration." Applied Financial Economics, 6: 91-101.

Seyhun, H.. 1990. "Overreaction or Fundamentals: Some Lessons from Insiders' Respose to the Market Crash of 1987." *The Journal of Finance* XXXXV, 5.

Shiller, R.. 1981. "The Use of Volatility Measures in Assessing Market Efficient?" *Journal of Finance* XXXVI: 291-304.

Sim, C.. 1980. "Macroeconomics and Reality." *Eonometrica* XXXXVIII: 1-48.

Sim, C.. 1982. "Policy Analysis with Econometric Models." *Brookings Papers on Economic Activity* I: 107-152.

Smith, K., J. Brocato, and J. Rogers. 1993. "Regularities in the Data Between Major Equity Markets: Evidence from Granger Causality Tests." Applied Financial Economics, III: 55-60.

Solnik, B.. 1977. "Testing International Asset Pricing: Some Pessimistic Views." *The Journal of Finance* XXXII, 2: 503-512.

Solnik, B., and A. Freitas. 1988. "International Factors of Stock Price Behavior." In *Recent Developments in International Banking and Finance* II: 259-176. ed. by S. khoury, and A. Ghosh.

Solnik, B.. 1991. "International Investment." 2nd Edition, Addison Wesley.

Summers, L.. 1982. "Do We Really KnowFinancial Markets are Effieient." *NBER Working Paper* No. 836.

Summers, L.. 1986. "Does the Stock Market Rationally Reflect Fundamental Values?" *The Journal of Finance* XXXXI, 3: 501-601.

Sun, B. K.. 1993. "DO Capital Contriols Affect the Response of Investment to Saving? Evidence from the Pacific Basin." In *Economic Review*: Federal Reserve Bank of San Fancisco.

Suzuki, Y.. 1986. *Money, Finance and Macroeconomic Performance in Japan.* Yale University Press.

Suzuki, Y., and H. Yomo. 1986. *Financial Innovation and Monetary Policy: Asia and the West.* Tokyo: University of Tokyo Press.

Talib, A.. 1993. *Monetary Policy in SEACEN Countries.* The SEACEN Centre.

Talor M.P. and I. Tomks. 1989. "The Internationalization of Stock Markets and the Abolition of UK Exchange Control." *Review of Economics and Statistics* LXXI: 332-336.

Tan, K., S. Tan, and I. Tang.1989. "Development of the Capital Market in Singapore." in Ng, B. 1989. *The Development of Capital Markets in the SEACEN Countries.* Kuala Lumpur, Malaysia: The South East Asian Central Banks

Tang, G.. 1995. "Intertemporal Stability in International Stock Market Relationship: A Revisit." *The Quarterly Review of Economics and Finance* XXXV: 579-593.

Taiwan Statistical Data Book. various issues. Council for Economic Planning and Development.

Tarumizu, K.. 1991. "The Role of Capital Markets in Asian Eocnomic Development." In *Pacific-Basin Capital Markets Research* II.

Thanachanan, C.. 1991. "Towards Financial Liberalization" In *Pacific-Basin Capital Markets Research* II. Amsterdam: Elsevier Science Publishers.

The Guild to World Equity Markets. 1993, 1995, and various issues. London: Euromoney.

Tseng, W. and R. Corker. 1991. "Financail Liberalization, Money Demand, and Monetary Policy in Asian Countries." In *IMF Occasional Paper* 84.

Urrutia, M.. 1988. *Financial Liberalization and the internal structure of Capital Markets in Asia and Latin America.* The United Nations University.

Viner, A.. 1988. *Inside Japanese Financial Markets.* London: Dow Jones-Irwin.

West, K.. 1987. "A Specification Test for Speculative Bubbles." *Quarterly Journal of Economics,* LLII: 553-80.

World Bank. *Global Development Finance.* 1997 and various issues.

World Bank. *Political Risk Services: Monthly International Country Risk Guild.* various issues.

World Bank. *Private Capital Flows to Developing Countries: The Road to Financial Integration.* various issues.

World Bank. *World Bank Economic Review.* various issues.

Yean, T., and H. Adnan. 1993. "Financail Institution and Investment Opporturnities in the Asia Pacific in the 1990s."*working paper* 22. Universiti Kebangsaan Malaysia.

Yuhn, K.. 1996. "Stock Price Volatility: Tests for Linear and Non-linear Cointegration in the Present Value Model of Stock Prices." Applied Financial Economics, 6: 487-494.